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METEORS AND FALLING STARS.

By RICHARD A. PROCTOR.

(*Continued from p. 405.*)

THE application of these considerations to Schiaparelli's theory is easily perceived. In order that a particle attracted from outer space may be compelled to travel in a closed orbit around the sun, its velocity must be diminished. And this can very readily happen. But for the particle to travel in an orbit of a particular extent or mean distance, its velocity where it crosses the distance of the disturbing planet must be diminished by a certain amount; and in dealing with Schiaparelli's theory, it is a cardinal consideration whether the observed orbits of periodic comets are such that we can admit the possibility of their resulting from any diminution of velocity which the disturbing planet could have produced. Take, for instance, the November meteors, which pass near the orbits of Uranus and the earth, and do not approach any other orbit near enough for any such effects upon the orbital motions of these bodies as we are now dealing with.* We may dismiss the earth from consideration at once, because our planet is far too small to modify the motions of bodies rushing past her with the velocity, nearly 26 miles per second, which the sun has communicated to bodies approaching him from interstellar space, by the time they reach the earth's surface from him. Uranus then alone remains. Now the present velocity of the November meteors when crossing the orbit of Uranus, amounts to about 1½ mile per second. The velocity of a particle approaching the sun from interstellar space would be nearly six miles per second when at the distance of Uranus. It may be seriously questioned whether, under any circumstances whatever, a particle crossing the track of Uranus without encountering the planet could be deprived of 4½ miles per second of its velocity. For though Uranus can deprive a body directly receding from him (and starting from his surface) of a velocity of about 13 miles per second, yet the considerations above adduced show that only a fraction of this velocity could be abstracted from a body moving past Uranus; and it is certain that if so large a reduction as 4½ miles per second could be effected at all, it would only be by a singularly close approach of the particle to the surface of Uranus.

But setting apart the improbability that a body arriving from interstellar space could be in this way compelled to travel in the orbit of the November meteors, the possibility of such a capture would not prove the possibility of the capture of a flight of bodies large enough to form that meteor system and its accompanying comet. If the whole material of the system and its comet had arrived in a compact body, the material attractions of the parts of that body would be sufficient to keep them together; whereas, in point of fact, the November meteor-system and its comet occupy at present a large range of space, even if the meteors be not scattered all round the orbit (however thinly along portions thereof). If, on the other hand, the material of the body were not in a compact form, the body would be necessarily large, and a portion of it only would be captured by Uranus. Nay, it is not even necessary that this should be conceded. For though we admitted that the whole of a large and tenuous body not kept together by the mutual attraction of its parts or by cohesion, might be captured, it is manifest that different parts would be captured in different ways, and would thenceforth travel on widely different orbits. That a system of bodies already drawn out into an extended column, and in respect of length already resembling the meteor systems we are acquainted with, could be captured, as Schiaparelli's theory requires, and all sent along one and the same closed orbit, is altogether impossible.

It is to be noticed also that we gain nothing, as respects the interpretation of meteor systems or comets, by adopting Schiaparelli's hypothesis. To assume that meteoric matter has been wandering about through interstellar space, until the sun's attractive influence drew such matter towards the solar system, is to explain a difficulty away by advancing another still greater; moreover, we have not a particle of evidence in support of the supposition. To suppose, on the other hand, that meteor-flights have *crossed* the interstellar spaces, coming to us from the domain of another sun, is to remove the difficulty only one step. We know that comets pass away from the domain of our sun to visit some other sun after an interstellar journey of tremendous duration; and to suppose that comets, whether of hyperbolic or elliptic orbit, came to us originally from the domain of another sun, is merely to suppose that that happened to such comets millions of years ago which we know to be happening to other comets at this present day, but not by any means to explain the nature of comets or their origin. We know that many comets leaving our system to visit others had not their origin within our system; and we cannot assume as possible or even probable that any comet had its origin within the domain of another sun than ours, unless we assume as possible or probable that some among the comets leaving our own sun had their origin within our sun's domain. And what is here said of comets must be understood as applying to meteor systems.

Thus, then, we are led to the conclusion that whether we adopt, with Schiaparelli and others, the theory that comets or meteoric systems can be drawn into the solar domain, or regard such an event as of very infrequent occurrence, or reject it as impossible (which we safely may), we still find that the origin of comets must be looked for within solar systems; or rather, since we cannot claim to trace back comets any more than planets or suns, to their actual

* Both Jupiter and Saturn can perturb the November meteors, and thus modify the shape and position of the meteoric orbits; but such changes, though by no means inappreciable, are utterly insignificant compared with those required to change the motion of a body approaching the sun from interstellar space into motion in an orbit like that of the November meteors.

origin, we may say that at an early period of their existence comets belonged to the solar system. The system has had no more occasion, so to speak, to borrow meteor systems from other systems—that is, from other suns—than these have had to borrow meteor systems from it and from each other.

We decide, then, that meteor systems may certainly be classified into those which have belonged to our solar system from the earliest period of their history, those which visit it from without, and pass away to other suns, and an intermediate class, consisting of those which, having visited it from without, have been constrained, by perturbations affecting them within it, to become attached permanently to its domain. We may note also that as there are meteor systems now belonging to our solar system which originally belonged to other solar systems, so probably many meteor systems originally belonging to our solar system are now either attending on other suns or wandering through the star-depths from sun to sun.

It has been from viewing the matter in this way, recognising the almost decisive evidence that meteor systems have from earliest times been members of our solar system, that I have been led to inquire into the possibility that some meteor systems may have been expelled from the sun, and that others—those, namely, which seem attached to the orbits of the giant planets—may have been expelled from those planets when in their former sunlike condition. The evidence to show that there is an adequate expulsive power in the sun is striking, and we may reasonably infer that the small suns formerly dependent upon him had a similar power. The motions of the members of the comet-families of Jupiter, Saturn, Uranus, and Neptune, accord far better, too, with this theory than with Schiaparelli's.

(To be continued.)

OUR HOUSEHOLD INSECTS.

By E. A. Butler.

COLEOPTERA (*continued*).

A CORRESPONDENT has suggested that it would be well to give the etymology of the scientific names of the insects referred to in this series of papers. This would, no doubt—in some cases, at least—prove a help towards remembering the names: but there would be little other advantage, for it must be remembered that the signification of the names is, from a scientific point of view, a matter of very little moment; in fact, when once given they become *proper* names, and therefore, like other words of that class, are used merely as symbols to denote the objects referred to, regardless of their original meaning. Doubtless it would have been an advantage if the scientific name of a natural object could have been a sort of compendious description of it; but, from the multiplicity of the objects to be named, their frequent close resemblance to one another, and the impossibility of compressing a sufficient amount of information into the short space of two words, such a scheme is incapable of realisation. Hence it is unsafe to endeavour to form an idea as to the nature and habits of the creature from the original import of its name, and very little is lost by disregarding the etymology altogether.

This remark, often applicable enough even with respect to generic, applies with much more force to specific names, and of these it may safely be said they are almost as frequently misleading as helpful, especially such as refer to peculiarities of colour—so much so, indeed, that the question has been raised whether it would not be as well to do away with them altogether, and substitute for them either letters or numbers. They are sometimes given in reference to some feature which, though marked enough in the species in question, is yet not characteristic, being possessed in almost equal degree by several others; and even when thoroughly characteristic at the time of their first application, they may cease to be so through the discovery of other species possessing similar peculiarities.

An illustration will, perhaps, make this clearer. Suppose a genus of beetles containing a considerable number of species, all with dark legs, and suppose, further, a new species is discovered which, unlike the rest, has yellowish legs; it is not unlikely that, in naming this insect, its most obvious point of distinction will be seized upon, and it will be christened *flavipes*, "the yellow-legged." After a time, however, another species of the same genus is discovered, which has even yellower legs than the last; what is to be done now? It would cause endless confusion to transfer the name of the former species to the present, and re-name the old one, and, therefore, the new species is named after some much less obvious peculiarity—say, a little depression on its back, which it has in common with half-a-dozen other species—and so it is called, say, *impressus*. The original *flavipes* is no longer *the* yellow-legged species, and yet it must retain its name, while the new-comer, which has a far better claim to the name, receives a designation which altogether ignores its strongest peculiarity. It is easy to see that a novice, on capturing the yellow-legged *impressus*, and running his eyes over the list of British species and seeing there a *flavipes*, may not unnaturally, and yet most erroneously, jump to the conclusion that this must be the insect he has secured. This is not altogether an imaginary case, and many of such a kind might be mentioned.

Then, again, sometimes a name is given ironically, as, for example, when a moth remarkable for the extreme length of its wings is called *abbreviata*, and a beetle, so minute that, without a microscope, it is scarcely possible to tell whether it be an insect at all, is dubbed *Titan*, after those mighty sons of Earth and Heaven who, according to the wisdom of the ancients, cost even Zeus, the Thunderer, many a hard struggle before they could be overthrown. The classical mythologies, indeed, have been ransacked for names; the Olympians now find themselves gifted with an objective, though inferior, existence, and the heroes and demigods of old live again in the hosts of the insect world. A raid has also been made upon the mythology of India, which has been forced to yield names for the ever-increasing hosts of creatures that come up for registration. Sometimes an insect is honoured with a piece of barbarous Latinity in the form of *Jonesi* or *Smithi*, or the like, in recognition of the great merits of its discoverer, and finally, in many cases, there is no etymology at all, the names being purely fanciful ones, which in practice, however, answer just as well as any others. From these illustrations, it will easily be understood that inappropriate baptisms are numerous, and that, therefore, no great importance must be attached to etymologies.

After these cautions, we may venture on a few words with reference to some of the names already used. The name *Anobium* is said to be from the Greek *aneu*, without, and *bios*, life, and would thus refer to the habit these insects have of counterfeiting death—a fairly appropriate title, though there are plenty of beetles belonging to genera not so named that indulge equally persistently in this habit. *Domesticum* (pertaining to the house) and *paniceum* (pertaining to bread) of course explain themselves when we remember the habits of the insects in

question. *Tessellatum* (tessellated), refers to the patches of pale colour on the back of the death-watch. In *Ptinus fur* we have a trivial name—*fur*, a thief—eminently condemnatory of its possessor, and fully justified by its destructive habits; another of the same genus has also been branded with an equally opprobrious epithet—*latro*, the robber. Both the names of *Ptilinus pectinicornis* refer to the same peculiarity, the comb-like antennæ of the male, the generic name signifying a "feathered creature," and the specific, "comb-horned." *Hololeucus* (Greek, entirely bright) refers to the uniform silky lustre produced by the golden scales of *Niptus*.

To return to our spider-like trio, the first we have already

Fig. 1.

considered; the second, *Mezium affine* (Fig. 1), is even more spider-like than its predecessor. Unlike *Niptus*, however, it is clothed with hairs only on the head and thorax. Its elytra are perfectly bare, of a chestnut brown colour, brilliantly shining, and extremely globular, very much like what those of *Niptus* would be if denuded of their scales. The head and thorax are covered with yellowish white hairs, so thickly disposed that you might imagine the creature was of an asthmatic temperament, and so needed to protect itself by wrapping its upper regions in a great woollen muffler or comforter.

This is not nearly so common an insect as the last, but it is equally varied in its tastes. An old opera-hat, which had been laid aside for some time, once nourished a considerable colony, and it has also been found inside the carcase of another beetle, the greater part of whose contents its larva had devoured; the creature had passed through the whole of its changes in these contracted quarters, the larva having formed there a silken cocoon intermixed with particles of its own excrement.

The third member of our little party is *Gibbium scotias* (the hump-backed lover of darkness) (Fig 2). It is much

Fig. 2.

like *Mezium*, but more stumpy, and entirely destitute of hairs, except on its antennæ and legs. It looks more like a great mite than a spider, and from its colour and rotundity has been fancifully compared, especially when tucking its legs under its body, to a drop of blood.

At Newcastle this insect has been found in some numbers in a dry cupboard, where, it would seem, they had obtained a comfortable living from the wall-paper and the dried remains of the paste with which it had been hung. This latter is a very favourite repast with several small insects that are pests in natural history collections; it is well, therefore, to take the precaution to mix a little corrosive sublimate with the paste used in papering the mounting-boards for zoological specimens, that by being thus poisoned, it may become safe from the attacks of the tiny depredators. *Gibbium* has also been found amongst old hay, and on one occasion a heap of their carcases was discovered amongst a resinous-substance in a vase obtained from a mummy at Thebes, but whether they were an original embalmment or a subsequent invasion was not very clear.

(To be continued.)

OVERHEAD ELECTRIC WIRES.

By W. Slingo.

MANY, if not the great majority, of the readers of KNOWLEDGE are aware that for some time past a Select Committee of the House of Commons has been considering the law relating to the control over telegraph, telephone, and other wires, with a view to reporting to the House upon the steps, if any, which ought to be taken in the interests of the public. This Committee has issued its report, which is in direct opposition to the draft submitted by the chairman.

This report, however, bears so very strongly the stamp of a partisan spirit, that it is a matter of impossibility for an uninterested observer to regard it with equanimity.

In the first place the report says that "the risk of danger from overhead wires has been very greatly exaggerated." It then proceeds to declare that "the accidents which have been proved in evidence have been few and insignificant." Taking these clauses together, they may fairly be read to mean that as few disasters have resulted from the breakdown of overhead wires, therefore few, if any, are to be apprehended. There is no greater fallacy under the sun than this. Let it be borne in mind that, with the exception of the storm which visited London last March, and which wrecked hundreds (I speak within the margin when I say hundreds) of wires, the South of England has enjoyed tolerable immunity from such visitations for nineteen years. Then nearly every channel of electrical communication was destroyed, and we have surely no guarantee that such a storm may not again visit us at an early date. This year's storm took place on a Saturday evening, when the business thoroughfares were practically deserted. Considering the amount of damage wrought upon property, the loss of life, and personal injury that must have resulted had the storm occurred in the morning or afternoon, it is impossible to conceive. And if such calamities are possible to-day, what must be the state of affairs a dozen years hence, when the wires will, in all probability, be enormously increased in number, and when those now in existence will have been reduced in places almost to threads? Sir John Hawkshaw and Dr. Percy are no mean authorities on the strength of materials, and the Doctor's reference to this subject at the recent meeting of the Iron and Steel Institute, demands every consideration. He said:—

I trust that a word or two on a question which is now exciting considerable attention and causing alarm in the public mind may not be deemed irrelevant. I allude to the daily increasing danger from the possible fracture of overhead telegraph wires, and especially cables. So long ago as 1866 I addressed a letter to the editor of the *Times* on the subject, in which this new source of danger to the inhabitants of London was pointed out; and to show that it was not imaginary, an instance of a fatal accident having occurred from this cause a short time previously was adduced. It was that of an unfortunate man who, while seated on the top of a vehicle, was killed and nearly decapitated by the sudden breakage of an overhead telegraph wire. My friend, Sir John Hawkshaw, who, it will be admitted by all who have the pleasure of his personal acquaintance, is no alarmist, has, so lately as last month (April, 1885), addressed emphatic words of warning to the public, through the medium of the *Times*, concerning this

new danger. Life is said to hang upon a thread, and now the life of a Londoner may be said to hang upon a wire, which is but a metallic thread, and with much greater reason to depend upon a heavy telegraph cable. Should any great diminution in the tensile strength of these wires, from physical or other causes, take place in the course of time, it is difficult to conceive how mischief in consequence should be prevented, inasmuch as it would, to say the least, be exceedingly difficult to make a proper inspection of them; and, moreover, even if such inspection were easily practicable, it would probably be neglected until a political dignitary like the Home Secretary or the Postmaster-General should happen to be strangled, or, it may be, decapitated, by a broken wire, or crushed by a broken cable. In the event of such an unhappy accident, this unsightly and dangerous nuisance might possibly be suppressed.

It is urged by some that hard-drawn copper, a recent innovation, is a tolerably good safeguard, inasmuch as it combines with good electric conductivity and oxygen-resisting powers of a high order, a tensile strength approaching that of steel. It is noteworthy, however, that, because of its high conductivity and its relatively high price, the gauge of such wire is very small. A deal of this wire has been erected recently, and stands well in a gale of wind. The snowstorm of last March, however, was unaccompanied by wind. The snow froze on to the thin wire to a diameter of 2 in. or thereabouts. Then there sprang up a wind, and down came the wires wholesale. It is notorious that they suffered much more than the old-fashioned iron wire. We see then that there is absolutely no guarantee that we shall not sooner or later experience a calamitous assault by truant wires flying in all directions. There is one little saving-clause that might have been, and which ought to have been, introduced, and that is that, where overhead wires are necessary, they should only be permitted to cross the street at right angles, and be at such a height that the distance from the ground should be at least as great as the distance between the two supports sustaining the wires over the street. There would then be little danger of any further accident than a shaken roof or a few broken windows.

It is also argued that the benefit conferred by the telephone is too great to be sacrificed for the sake of saving a few lives, more or less, and the finger is pointed to the many deaths which result from overrunning by horses and vehicles. There is, however, this difference to be noticed, viz., that such deaths are really preventible, and almost invariably result from want of care somewhere or other, while such disasters as are likely to be caused by broken wires cannot be guarded against. Further, it is practically impossible to send our horses and carriages underground, while there should be no reason why telephone wires should not be placed there. To say that the telephone will not work on an underground system is to beg the truth, seeing that it *is* so worked. We should, I am convinced, hear a different tale were the wires once underground. We should then hear of their superiority over aërial circuits, subjected, as the latter are, to the elements, to the swaying of the wind, and so forth. If electricians cannot now overcome induction between wires, they would soon find a means for doing so.

But of all the outrages ever perpetrated, is there one that equals the opinion of the committee, "that, under proper regulations, permission should be given to pass wires over property without the owners or occupiers having the right of prohibition"? The Telephone Company was not so far out, then, when it strove to introduce clauses into its Bill before Parliament empowering it as it pleases to erect poles on and attach wires to houses, or to erect poles within three feet of a house—one planted in front of the doorway, for instance. Of course, with the right to erect poles must be given the right to enter houses at pleasure. Nothing, in fact, must be withheld.

But supposing these concessions granted, would permission be withheld from householders to cut such wires as happen to be in their way? or, more important still, could permission be any longer withheld from the electric light companies to run overhead wires at pleasure? If that right were granted, how would the telephone get on then? It would have passed from confusion into confusion ten thousand times confounded.

It is, then, to be hoped that such legislation as is foreshadowed by the report may never see the light of day, for far better would it be to let things go on as they are with the certain knowledge that a catastrophe must happen sooner or later, and that it would look undignified to have to withdraw a concession once made in good faith.

THOUGHT AND LANGUAGE.

By Ada S. Ballin.

IX.

MAN at the present time uses gesture-language, generally in conjunction with articulate speech; but it also forms a bond of union between peoples of different tongues, and between speakers and those who, owing to disease or organic defect, have no power of speech—a means of communication common to all mankind.

Besides those gestures of which I have already spoken, there is another class of gestures which may be styled "pantomimic;" they come under the head of gestures expressive of thought, and are purely imitative. They are understood by every one, because they are as far as possible pictorial representations of things and actions, and reproductions of the manifestations which accompany feelings.

If anything to which reference has to be made is present, it is either touched, or if out of reach is pointed at, as if it were touched from afar; if it is out of sight, the most striking characteristic is imitated, and it is recognised by the rough sketch thus given.

For example, in grief, the contraction of certain facial muscles gives the countenance an appearance of being drawn down. We talk about a person "pulling a long face," when in trouble; and a party of natives in Tierra del Fuego explained to Darwin that their friend, the captain of a sealing vessel, was out of spirits, by pulling down their cheeks with both hands to make their faces look as long as possible.

The pictorial or imitative origin of gestures, such as the following, is apparent on very superficial investigation, and it can easily be seen why they are so universally understood.

It is a well authenticated fact that North American Indians, similarly with English deaf-mutes, if they desire to represent the act of *walking* adopt the same pantomimic action, by moving the first two fingers alternately, tips downwards. Again, each of the above, to indicate *riding* straddles the first and second fingers of one hand across the index of the other, which represents the mount. Holding the two forefingers side by side means *husband and wife* or *companions*, and is said to be understood everywhere. *Meat* is indicated by pinching up a bit of flesh on the back of the hand, while the imitation with the forefinger of steam curling upwards shows that hot, cooked meat is intended.

To touch the ear with the forefinger is "to hear" and the tongue "to taste," while "to see" is expressed by darting out the first and second fingers from the eyes, like rays. The sign for child is to hold the right arm with its elbow resting on the left hand, representing the way in

which a baby is held. For "come" they beckon, as it were to draw the person to them, and "go" is shown by waving the hand outwards; pushing him away. For the pronouns, "I" the forefinger is pointing towards the pit of the speaker's stomach, for "thou" it is pointed towards the person spoken to, for "he" the thumb is sometimes pointed over the right shoulder. For "red" the inside of the lip is touched, to express "green" the grass is pointed to. Interrogation is shown by looking or pointing about in an uncertain way. I am not now speaking of the finger language which is taught to deaf-and-dumb children, and is an artificial system based on the ordinary alphabet, and by means of which words are spelled in the ordinary way. Gesture language, such as that above referred to, is not taught, but seems to be naturally developed in the deaf and dumb, who attain a proficiency in it which their teachers could never acquire. Some of the signs used become, in the course of time, conventional, but the majority sufficiently retain their natural character to be recognisable by the civilised deaf and dumb when used by the savage, and *vice versâ*. Mr. Tylor says: "I am sure that a skilled deaf-and-dumb talker would understand an Indian interpreter, and be himself understood at first sight, with scarcely any difficulty. The Indian pantomime and the gesture-language of the deaf and dumb are but different dialects of the same language of nature,* to which, as he remarks elsewhere,† the Chinese mythic description of the primeval language may be applied. "Suy-jin first gave names to plants and animals, and these names were so expressive that by the name of a thing it was known what it was." "The best evidence," he says,‡ "of the unity of the gesture-language is the ease and certainty with which any savage from any country can understand and be understood in a deaf-and-dumb school. A native of Hawaii is taken to an American institution, and begins at once to talk in signs with the children, and to tell about his voyage and the country he came from. A Chinese who had fallen into a state of melancholy from long want of society, is quite revived by being taken to the same place where he can talk in gestures to his heart's content." A deaf-and-dumb boy was taken to see some Laplanders, and one of the women who would not speak at first, when she discovered his condition, got quite friendly, and chatted in gestures about reindeer and other subjects which interested her.

There is an oft-repeated story of two savages of different tribes who married; neither could speak the other's tongue, nor did either make any advance towards learning it, yet they lived together in peace and harmony for many years, conversing wholly in signs.

Captain Burton states that white men prefer interpreters learned in the art of sign-making to those better acquainted with the verbal language. "A man being sent among the Cheyennes to qualify himself for interpreting, returned in a week, and proved his competence; all that he did, however, was to go through the usual pantomime, with a running accompaniment of grunts."

It is possible for a connected speech to be delivered wholly in signs, and Captain Burton gives the following narrative as a specimen of how an Indian would render it. "Early this morning, I mounted my horse, rode off at a gallop, traversed a kanyon or ravine, then over a mountain to a plain, where there was no water, sighted bison, followed them, killed three of them, skinned them, packed the flesh upon my pony, and returned home." The signs would be arranged thus: "I—this morning—early—mounted my horse—galloped—a kanyon—crossed—a mountain—a plain —drink—no !—sighted—bison—killed—three—skinned—packed flesh—mounted—hither."

Taken in connection with Captain Burton's example, the following is of interest, as there is great similarity between the modes in which the savage and the deaf child express themselves. "A boy saw a tree on which several birds were sitting. He thought to himself, 'I should like to catch some of these,' so he crept gingerly under the tree, took out his pocket-handkerchief, spread it on the ground, and began to shake the tree. To his great astonishment, the birds did not fall down, but all flew away. Very disappointed, he took up his handkerchief again, and went home. What an ignorant boy." A deaf-and-dumb child would tell this exciting episode in the following way:—Sign for boy—there—tree—many—birds—happy—think —some—birds—I; then he would look towards the imaginary tree, step towards it on his toes, puts his hand in his pocket, take out his handkerchief, spread it on the ground, and shake the tree. All this is done with a joyful expression; but then he looks up, opens his mouth with astonishment, which passes quickly into disappointment, and then bends down, picks up his handkerchief, puts it away, retreats with his head down and looking sad. Finally he laughs, shrugs his shoulders, and makes the sign for ignorant or don't know, the grouped fingers being put to the head, and then quickly opened out from it.*

A still more interesting example of a continuous narrative expressed in signs is quoted by Mr. Tylor,† being the last will and testament of a man named John Geal, who was deaf and dumb, and could neither read nor write. The will is too long to copy here, but a few of the expressions used therein may be quoted with advantage. When referring to his money, he touched his trousers pocket; to more general property, he swept his arms all round. He laid his head on the palm of his hand, with his eyes closed, to signify "death, decease," and put his forefinger into his mouth for "child"—a sign which has always been popular, and which an ancient Egyptian would have understood, for on the monuments, Horus, the son of Isis and Osiris, is always represented with his forefinger in his mouth, to show that he is a child. The sign, doubtless, originated in imitation of the sucking of infants.

* "Early History of Man," p. 35. † Ibid. p. 60. ‡ Ibid. p. 54.

* The story is from Moriz Hill's "Anleitung zum Sprachunterricht Taubstummer Kinder." 1840.

† "Early History of Man," pp. 29-30.

CHATS ON GEOMETRICAL MEASUREMENT.

By Richard A. Proctor.

THE CYLINDER.

A. We turn now from prisms and pyramids, to cylinders and cones. With which of these shall we begin?

M. With cylinders; for they bear the same relation to prisms that cones bear to pyramids; and we had to deal with prisms before we could deal with pyramids.

A. What is the curved suface of a cylinder?

M. I can only answer for the case of a right cylinder,—the curved surfaces of oblique cylinders cannot be determined without the higher mathematics.

A. Can you deal with any right cylinder?

M. No; only with the right circular cylinder.

A. What then is the surface of a right cylinder?

M. It is equal to a rectangle, one side of which is equal in length to the circumference of the circular base of the

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cylinder, while the adjacent side is equal to the cylinder's height.

A. How do you prove this?

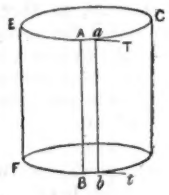

Fig. 1.

M. Let A D F (Fig. 1) be a right cylinder on the circular base, F B D, A B, C D, E F being generating lines. Then we might divide the whole curved surface of the cylinder into small areas like A B *b a*, and show that each of these approaches in area to a rectangle having B *b* for base and A B for height. Adding all such rectangles we should obtain a rectangle having the circumference of the circle F B D for base and A B for height. But it is simpler to suppose the cylinder rolled on a plane, till its whole surface has touched the plane. If the generating line A B (Fig. 1), touches the plane at the beginning of the rolling as in A B (Fig. 2), it is obvious that the surface rolled over will be such a rectangle as A B′ where B B′ is the straight line traced by the circle F B D, A A′ the parallel traced by the circle E A C, and A B, *a b*, C D, E F in Fig. 2 are the lines touched by the correspondingly lettered lines of the cylindrical surface A F D in Fig. 1; A′ B′ being where A B of Fig. 1 again reaches the plane.

A. It seems tolerably obvious. But how do you *prove* that the circular edges of the top and bottom of the cylinder will trace parallel lines?

M. As you begin to roll the cylinder from contact with A B, it is evident that as A T, B *t*, the tangents at A, B, to the circles E A C, F B D, are square to A B, the beginning of the rolling starts the traces A *a*, B *b*, Fig. 2, square to A B, the next trace *a b* being parallel to A B. Thence to the next trace and the next; so that *starting* along the perpendiculars A *a*, B *b*, to A B Fig. 2, and all the time moving squarely to A B, the successive points of the circles E A C, F B D in Fig. 1 cannot move otherwise than along the parallels A A′, B B′, Fig. 2.

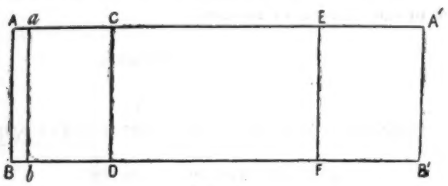

Fig. 2.

A. And now for the volume of a cylinder.

M. In this case we are not limited to right circular cylinders, but can deal with oblique cylinders, and cylinders of any section, so only that we know the height and can determine the area of the base.

A. How do we proceed?

M. Let A D G *k*, Fig. 3, be a cylinder, on the base A C F H, A *a*, B *b*, C *c*, &c., being generating lines; and therefore, by the general definition of a cylinder, all these lines equal and parallel to each other. In the curvilinear area A B C D E F . . . , describe a polygon A B C D E F . . . having a great number of sides, *a b c d e f* . . . being the corresponding polygon in the curvilinear area *a b c d e f* . . . Then we have a prism A B C . . . *a b c* . . . , enclosed within the cylinder A D G *k*. And manifestly we can make the volume of the enclosed prism as nearly equal as we please to the volume of the enclosing cylinder, by taking the points A B C . . . . L, sufficiently near to each other. For,

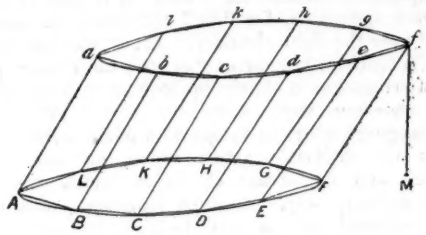

Fig. 3.

the thin slices A B *b a*, B C *c b*, &c., left outside the prism, will together be less than a shell enclosed between the cylindrical surface A D G *k*, and another having the planes *a f*, A F, for its flat surfaces, and touching the planes A B *b a*, B C *c b*, &c., and this shell may be made as thin as we please, by making the sides A B, B C, C D, &c., of our polygon as short as we please.

A. Hence the cylinder A D G *k* is ultimately equal to the prism A B C . . . . *a b c*?

M. Yes; and this prism, since the rectilinear area A B C . . . . L is ultimately equal to the curvilinear area A D F H is equal, by what was shown in dealing with prisms, to the volume of a rectangular parallelopiped having its base equal in area to A D F H, and its height equal to *f* M, the height of the cylinder.

A. Then in the case of a right circular cylinder, having *h* for height, and *r* as the radius of its circular base, the volume of the cylinder is represented by $\pi r^2 h$?

M. Precisely; while the volume of a right elliptical cylinder, whose height is *h*, and the semi-axes of its elliptical base *a* and *b*, is represented by πabh.

The curved surface in the former case is represented by $2\pi rh$, and the total surface of the cylinder by $2\pi rh + 2\pi r^2$, or by $2\pi r\,(r+h)$; so that the total surface of a right circular cylinder is equal to the rectangle under the circumference of the base and the radius *plus* the height.

(To be continued.)

Photography.—The article in this month's *Cornhill*, on "The Rise and Progress of Photography," is by our contributor, Mr. W. Jerome Harrison, F.G.S.

At a meeting of the Anthropological Institute on May 12 Mr. J. H. Kerry-Nicholls read a paper on "The Origin, Physical Characteristics, and Manners and Customs of the Maori Race." Whatever may have been their original course of migration, there can be no doubt that the Maoris owe their origin to the Malay stock. They are tall, well-built, and erect, with broad chests and massive limbs, which usually display great muscular development. The Maoris have longer bodies and arms, with shorter legs, than Europeans of similar stature, the feet are short and broad, and the hands small and tapering; the hair is coarse, black, and straight, and the skin of a brown coffee-colour. Half-castes are not uncommon, and are remarkable not only for their fine, well-formed persons, but also for their intellectual powers. The race is rapidly dying out, owing chiefly to diseases contracted by contact with civilisation, and not a little to the immoderate use of tobacco by young and old of both sexes. The native religion is a kind of polytheism—a worship of elementary spirits and deified ancestors. The priests held an exalted tribal rank, and were believed to possess miraculous powers; the Maoris acknowledge the existence of the soul after death, but do not believe in corporeal resurrection, nor in the transmigration of souls, and they seem to have some rather indefinite ideas of a heaven and a hell.

NOBERT'S RULING MACHINE.*

BY JOHN MAYALL, JUN., F.R.M.S., F.Z.S.

THE ruling machine of the late Herr F. A. Nobert, which I have the honour to bring to your notice this evening, in so far as its special applications for the production of microscopical test-plates, interference-plates, and diffraction gratings are concerned, must, I think, be regarded as of essentially original design. I have not been able to connect its origin with any ruling machine of anterior date, though I have searched somewhat diligently through sundry journals and transactions of various societies, and have had the assistance of Dr. Hugo Schröder, who is well known to have taken much interest in fine mechanism, and more especially in Nobert's work, during the past thirty years, and who has sought to inform himself from every available source.

I may at once state that, without the co-operation of Dr. Schröder, my notes on Nobert's machine would have been far less complete than they are; and I must, therefore, at the outset, acknowledge my obligations to him for many explanations and conjectures, without which several important points of the construction would have baffled me.

I should also premise that Herr Nobert was extremely reticent as to the methods he employed in the production of his rulings. So far as I have been able to learn, he did not fully communicate his methods to any one competent to convey the information to others. The description, therefore, which I shall present to your notice will consist almost wholly of notes made by Dr. Schröder and myself, after minutely examining every part of the machine, together with a few gleanings from the memorandum-book in which Herr Nobert jotted down, from time to time, fragmentary observations and data, hardly to be understood by any one but himself.

But, first, for the information of those of my hearers who may never have heard of Nobert's rulings, permit me to make a few introductory observations as to the meaning and purpose of fine rulings, so as to lead up gradually to a comprehension of the problems which Nobert set himself to solve, and the methods he adopted towards their solution. In this way I hope not to have to draw too much on your imaginations when I come to speak of the difficulties of his work, of the mechanical resources he developed in grappling with these difficulties, and of the success he attained.

I have here an ivory scale divided to hundredths of an inch, the divisions of which are filled with wax and graphite, so that the lines appear black and the interspaces white. Every one present, who has normally good sight, will have no difficulty in resolving the lines, that is, in seeing by the unaided eye the spaces between the consecutive lines, provided the scale be suitably illuminated. Those smong you who not yet tried the experiment will be surprised to observe how much more perceptible are the lines if illuminated by a condenser. If ivory scales were accurately ruled, so that each line was equal in breadth to the interspace, some of you would resolve, without much difficulty, lines as high as 150 to 200 to the inch with the unaided eye, whilst here and there exceptionally powerful sight would resolve lines even closer. These figures would be slightly augmented if the lines were ruled on glass, and viewed under the most favourable circumstances by transmitted light. I have met with one instance where lines on glass, slightly closer than 250 to the inch, were resolved by the unaided eye.

I would here call your attention to a point which has frequently produced misunderstandings in discussions relating to the possibility of perceiving fine lines. In referring to the resolution of lines, I mean the capacity of separating, in vision, adjacent lines, that is, the recognition of the interspace. This resolution must not be confounded with the capacity of mere perception of a line or point, that is, the recognition of the *minimum visibile*. Many experiments have been devised with a view to determining the conditions and limits under which the eye resolves lines or points of interspace of a given fineness, but the problem has not been absolutely solved, so far as I am aware. Neither have the conditions or limits under which the eye may reach the *minimum visibile*—the perception of a line, or point, in an otherwise homogeneous field of view—been worked out with any approach to demonstration, for it still remains to be explained under what optical and physiological laws we are able to perceive stars which do not subtend an appreciable angle, even to our finest optical and measuring appliances.

I have here a series of stage-micrometer rulings on glass, commencing with fifty to the inch, and progressing to 10,000 to the inch. They probably belonged formerly to the possessor of a microscope in the days when the measurements of objects were generally made by direct inspection and comparison under the microscope, and before the introduction of the modern methods of measuring by screw-micrometers, either on the stage or in the eye-piece. These old rulings are of fair quality, and I show them with a view of fixing in your minds a standpoint from which the fineness of Nobert's rulings may be appreciated.

Early in the century, Frauenhofer gave a great impetus to fine rulings by the production of his diffraction gratings, in which he aimed at and achieved a standard of accuracy in division and perfect similarity as to depth, breadth, and symmetry of angles of the furrows, such as had never before been formulated. He succeeded in ruling lines much closer than those contained on the highest of the series of micrometers I exhibit—as high, indeed, as 30,000 to the Paris inch; but, according to Sir John Herschel,* these fine lines were not sufficiently accurate to produce pure spectra, nor could he go beyond 8,200 lines to the inch when they were submitted to this most searching test of accuracy. Sir David Brewster† mentions that Barton produced rulings on steel up to 10,000 to the inch, which gave excellent spectra in his hands. Some of you probably have seen the so-called "Barton's buttons," which were stamped from his ruled steel dies.

(To be continued.)

* From the *Journal of the Society of Arts*. A paper read before the Society on May 6.

* Art. "Light," "Encyclopædia Metropolitana," p. 489.

† "Optics," "Lardner's Cyclopædia," p. 120.

CHAPTERS ON MODERN DOMESTIC ECONOMY.

XXVIII.—THE FRAMEWORK OF THE DWELLING-HOUSE.

STRUCTURAL EXAMPLES (*continued*).

THE DISPOSAL OF HOUSEHOLD REFUSE.

IN the closing paragraph of our last communication, we noted that the majority of closet appliances now in the market, and constructed upon what is known as the "wash-out" or "flush-out" type, are defective in two important particulars. They retain too little water within the basin, and the necessarily lateral position of the outlet requires a very powerful flush to operate at all successfully. These difficulties have, however, been overcome at

last by recent inventors, who have experimented both upon the shape of the basin and the application of the water-flush thereto.

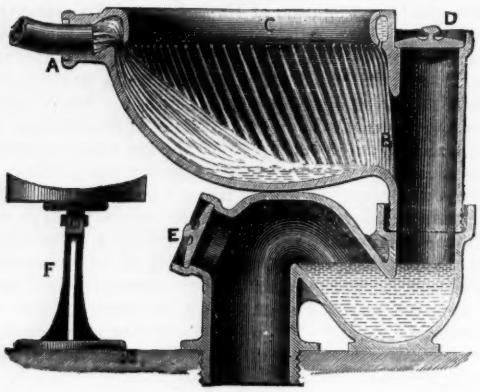

Fig. 28.

Fig. 28 is a sectional drawing of one of the best forms, known as the "Lambeth Improved Flush-out Closet," a brief description of the mechanism of which will help to explain what a thoroughly good closet of this class should be. The shape of the basin is such as to retain the greatest amount of water within its hollow, which shall at the same time offer the least resistance to the action of the flush. The vast bulk of the water enters the basin at the flushing-arm, A, and secures a strong flush by discharging exactly opposite at the outlet, B, whilst the sides of the basin are simultaneously cleansed by way of the flushing rim, C. The removable plate, D, gives ready access to the trap beneath, and a socket, E, can be utilised for ventilation. The circular top of the basin facilitates its being turned any way over the trap to suit the position of the soil-pipe, and, when necessary, an iron standard, F, can be had, on which to rest the basin.

But by far the most compact and effective series of flush-out closets in the market are those which have been invented by Mr. D. T. Bostel, of the Hygienic and Sanitary Engineering Company, Limited. They are known under the name of "Bostel's Patent Brighton Water-closets." (Fig. 29, A and B). The characteristics of value which

Fig. 29.—A, Section; B, Elevation, of Bostel's Prize Medal Closet.

distinguish these inventions may be summed up as follows: 1. There is a powerful flush, quite sufficient to remove any matters from trap, soil-pipe, and house-drain into the public sewer. With regard to this, we cannot do better than quote a portion of a letter submitted to us by the patentee. He says:—"I have fitted our show-room at Charing-cross with one" (in allusion here to a new "Intercepting" Drain-trap), "as it ought to be fixed; it is connected to a main drain leading to, and in connection with, the public sewer, and four or five closets are also connected with the drain leading to the trap and access chamber, so that any person can see and test its action and reliability as to the certainty of keeping the house free of sewage or drain-gases. Visitors can also at the same time test and prove the fact I demonstrate and claim for my closets and whole sanitary system, viz., that matter thrown or deposited in the w.-c., &c., can be flushed clean out of the house and drain into the sewer at *one flush*."

2. It will be seen from the sectional figure—A, Fig. 29—that the basin affords a deep trough for a rest of water, and that ample provision is made for its being thoroughly washed out upon every occasion.

3. There is no chance of an overflow of water, so that it forms a perfect slop-closet.

4. It is made in a simple piece of earthenware, and thus there cannot be any danger from leakage through insufficiently-guarded joints, &c.; at the same time thorough inspection and ventilation, without draftiness, is fully provided for. The Brighton closet thus includes all the requisites of a thoroughly sound appliance, and is, in the eyes of a modern sanitarian, ideally perfect.

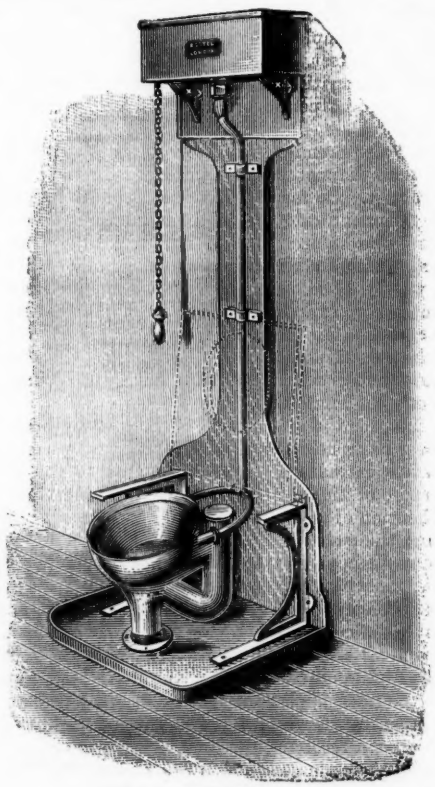

Fig. 30.

One excellent modification of the above is called the "No. 3 Brighton Excelsior," and in some respects may even be said to be an improvement thereon. It holds a larger quantity of water within the basin or receiver, and the outlet is in front, or out of sight. The flush of water, moreover, is delivered principally at the bottom of the basin, and is thus similar in action to a person sluicing a pail of water when cleaning a pavement. A small supply only comes in at the upper rim for the purpose of cleansing the sides of the closet. The access shaft is in front, and can thus be got at very easily in case of accident.

The entire surroundings of the closet, as it should be fitted, are clearly shown here at Fig. 30. The wooden framework which supports the simple automatic flushing

cistern with its 1¼ in. down supply-pipe, gives elegance as well as strength to the whole. The large ornamental brackets for supporting the seat, and the lead safe below, are improvements which ought to be followed by every plumber, since they contribute to cleanliness and health in the house.

NERVOUS EXHAUSTION.

By EDWIN WOOTON.

ROUGHLY dissected, the body shows to the naked eye a brain and spinal cord; from each of these, continuations or nerves proceeding to various parts of the frame. With the microscope the nerves can be traced until they become lost in the units or cells of which the body is composed. Hence, as I have said elsewhere, "The body of man is in reality a nervous system clothed with other tissues." Now this system has two great functions—elaboration and conduction of a particular form of *force*. The latter is dependent for its production on the brain, spinal cord, and certain nervous structures in the interior of the body termed "ganglia"; but as these last are maintained functionally by the power of the two former, it is with these alone we need at present concern ourselves. The nerves are merely conductors of force to the cells of the body in which their ultimate divisions terminate. While every particle of the animal frame has a life of its own, the millions of such particles of which the body is composed are held under control and governed as an unity or individual by the brain and spinal cord. The brain is the material organ of thought. It is an instrument of the most intricate and elaborate mechanism, used as a medium by a spiritual entity—the soul—which modern researches would lead us to believe is evolved from the nervous force before mentioned, with the development of the body in utero. Using a simile, the brain may be compared to a well constructed organ, and the soul to the musician. The various faculties of the mind have their localised seats of action in this physical apparatus of thought, but not according to the system of Gall and Spurzheim, the plaster heads representing which are doubtless familiar objects to my readers. Any injury to a particular part of this apparatus results in an impairment of the faculty or faculties having their normal seat in the situation of the lesion.

The spinal cord, including within the term, for the sake of simplicity, all that part of the cerebro-spinal nervous column below the brain proper, is the governing seat of non-mental actions, such as walking, breathing, &c. Beside their special functions alluded to, the brain and cord, like the rest of the nervous apparatus, conduct nerve force. The whole nervous system requires, for the performance of its functions, certain conditions. These are structural and chemical, and, consequent on these, electric and magnetic. In healthy, quiet-minded people all these conditions are found, and nervousness is due to deviations from these normal physical states. Waste and repair are being carried out in the human body during every moment of existence, and the waste of an organ is in exact proportion to the demand made on its powers. The repair is likewise in proportion to this demand, provided there be the presence in the blood of the materials necessary for such purpose, the result being development. But if the demand on an organ lead to an excess in the amount of material expended over that which can be supplied to it from the blood and elaborated into its structure, the part does not develop; it is physically injured, and incapable of performing its ordinary functions.

During the waking state, expenditure is carried on in excess of repair, and hence when healthy, not artificially-induced, sleep is felt to be needed, it is because the body, and nervous centres especially, are temporarily exhausted. During sleep repair proceeds in excess of expenditure, and the person awakes with his system restored to its normal vigorous condition. Thus a balance is struck daily.

Life has no station so exalted, intellect no power, and wealth no influence, that their possessors can derive therefrom happiness, or aught approaching it, if they suffer from that dread physical condition we are about to consider. Many are the hard-headed men of business, who, by the gradual establishment of this wretched state of being, have been compelled to relinquish their pursuits, or to carry them on under mental tortures which make existence a very curse.

This disease is essentially one of civilisation; it is produced by the modes of life found in cities and homes, and is comparatively unknown amongst uncivilised nations.

The subject, involving as it does the laws governing man's whole mechanism, is one replete with scientific interest. Experiment and observation have laid bare those hidden causes which were once thought to be beyond the power of human fathoming, and science, with, to some minds, a pitiless and sacrilegious hand, but in reality with one that is humane, though all-daring, demonstrates in this year 1885 the physical causation of every morbid thought, motion, and sensation as clearly as she proves that any two sides of a triangle are, taken together, greater than the third side.

Nervous exhaustion may be congenital or acquired. The causes of acquired exhaustion may be considered as active and passive: in the former the usual amount of work on the part of the nerve centres is increased without an additional supply of material necessary for tissue repair; in the latter the supply of nutritious material in the blood is lessened without any prior alteration in the amount of labour. Remember that by "nutritious" material is meant that capable of being supplied from the blood to the tissues. Very many people who eat much and labour little, whether with mind or body, could throw additional work on their nerve centres without any change in the amount or character of their food being necessary, since in such persons the blood becomes richly stored with organic matter, which, not being required, is excreted in various forms, or stored up as fat. Supply beyond demand is, so far as concerns nutrition, merely waste.

The brain partakes, with the rest of the body, of this general law of waste and repair. Every thought, every emotion is accompanied by actual destruction of tissue, and its excretion from the system. So the performance of those functions, whose governing seats are situated in the spinal cord, is accompanied by waste of the latter's tissue, and the equivalence or deficiency of the repair will be governed by the conditions of blood supply already mentioned.

Nervous exhaustion may be divided, according to its causation, into two chief classes:—(1) General and (2) abdomino-central.

Each of these is capable of sub-division into (1) simple and (2) complex nervous exhaustion.

The abdomino-central class must be briefly dismissed, as space cannot be afforded for its full consideration. It includes true hysteria and hypochondriasis.*

General nervous exhaustion. The chief phenomena of the simple division are:—(1) Strong beating of the heart occurring after slight exertion or from emotional causes. The same effect may result from lying on the left side. (2)

* See "Mimosis Inquieta," by the same author in "The Journal of Psychological Medicine," Vol. VIII., Part II.

Weak action of the heart. (3) Palpitation of the heart. (4) Partial loss or weakening of the voice. (5) Vocal tremor. (6) Relaxation of the muscles, especially seen in the shaking of the head when walking; if a hat be worn, the brim acts as an index and vibrates at each step. If no hat be worn, the scalp at the back of the head will be seen to move. (7) Spasmodic muscular action as seen in hand trembling and sudden involuntary bodily movements. (8) Fits of perspiration and chills. (9) Irritability of the cognisant centres of the brain, as shown by fright at slight causes. (10) Sleeplessness.

(To be continued.)

RAILWAY PLANT AT THE INVENTIONS EXHBIITION.

WE are all so directly dependent upon railways as a means of transport from place to place, that the collection of railway material at the Inventions Exhibition is sure to attract considerable attention. Although, in many respects, the exhibit is a restricted one, nevertheless there are a goodly number of features in railway working brought prominently forward.

"First, foremost, and frontest," as Mr. Moore would say, is the mammoth engine by Mr. Webb, of the London and North-Western Railway. To this a brief or passing reference has already been made. Some of its features may, however, be appropriately mentioned here.

Without, perhaps, embodying much that is at this moment new in principle, it is nevertheless a monument of ingenuity and a testimony of unwearying patience. It is practically the outcome of some years of the closest and most enthusiastic application to the study of engine-building. It is called the "Marchioness of Stafford," and belongs to what is known as the "Dreadnought" type. It is a compound engine, and has two high-pressure cylinders, 14 in. in diameter and 24-in. stroke, and one low-pressure cylinder 30 in. in diameter and 24-in. stroke, the driving wheels being 6 ft. 3 in. in diameter. The leading wheels are of cast steel, the others of wrought iron. The working pressure is equal to 175 lb. per square inch. The weight of the engine empty is 39 tons 10 cwt., while the working weight is 42 tons 10 cwt. There are only three of these engines in use, seventeen others, however, being in hand at the Crewe works. The "Experiment," the first Webb compound which was built, ran 173,802 miles between the dates of February, 1882, and March, 1885, while the distance covered by the "Dreadnought" from September last until March 20th was 15,477 miles, with trains averaging twelve vehicles, between Crewe and Euston. The aggregate number of train miles which have been run by the various compound locomotives on the London and North-Western Railway is, to March 20th last, 1,826,031 miles. One great object in introducing the compound type of locomotive was to reduce the cost of fuel; and it is stated that an engine converted from the ordinary non-compound type, and running between Broad-street and Mansion-house on the District Railway, in the course of nine months ran 33,014 miles, with an average consumption of 23·5 lb. per mile, as against 31·4 lb. per mile by the other engines doing similar work.

This engine is standing on a length of steel permanent way of a pattern which has been introduced by Mr. Webb. The sleepers are rolled from Bessemer steel ingots, the weight of a complete sleeper being 174 lb., made up as follows:—Sleeper, 9 ft. long, 124 lb.; two chairs, 28 lb.; rivets, 5 lb.; two lining plates, 15 lb.; and two oak keys, 2 lb. A creosoted wooden sleeper, such as is more generally used, weighs 242 lb. complete. The balance in favour of steel is considerable, and, seeing that they are much smaller, more easily packed, and presumably more durable than timber, they are sure to come into favour ere long, and the wonder is that even for the erst intended Suakim-Berber Railway they were not adopted. There would have been no danger of their being burnt or stolen.

Automatic brakes are brought very prominently under notice, and deservedly so; for in these days of fast travelling and rapidly-following trains, it is absolutely necessary that the greatest possible security against collision or other accident should be provided. In the face of the fact that with proper apparatus a train may be drawn up in its own length, it is tantamount to criminal negligence to allow a train to run the risk of disaster with nothing between it and destruction but the brake-power which can be supplied by the engine to its own wheels, supplemented by the puerile efforts of the guard in the manipulation of his toy, otherwise dubbed a hand-brake. The exhibit by the Westinghouse Co. is very complete, practical, and impressive. We have already (Knowledge Nos. 147 and 149) enlarged upon this system, and need say no more concerning it, save that it is as secure as ever against competition. Its only enemy is its expense; but we are fain to imagine that when a company like the Brighton can afford to apply it to every train, expense is but a lame excuse, and nothing but an excuse.

The Vacuum Brake Company make a good display of their apparatus as employed on the Midland and other railways, but it is rather too crowded, and an air of mystery pervades it, so that it receives less attention than it might.

A source of attraction is a working model illustrating the Welch-Parker Smith Automatic Brake (pressure or vacuum). This is a modification of the Smith brake in use on the Great Northern Railway. The model consists of a carriage which is made to ascend a steep gradient, and which is arrested at the summit, and again at the middle of its descent by the application of the brake. Working models are always taking, this one especially so.

Another detail in railway-working is the buffer—by no means an unimportant detail. Several forms of spring buffer are exhibited, the Fairlie Engine Company showing specimens of Mr. R. H. Hepburn's encircling spring "stop." Spring buffers consist of very stout volute or conical springs of various kinds, encased in an iron chamber. It is found that the concussion frequently fractures these springs, and Mr. Hepburn's improvement consists in the addition of an encircling hoop, somewhat broader than the section of steel forming the spring. This constitutes an effectual "stop," whence the spring cannot be overstrained.

Couplings are responsible for the loss of life and limb to large numbers of railway employés every year, and every improvement which tends to reduce the risk of such accidents is worthy of serious attention. The Brocklebank Automatic Coupling has the merit of being workable without necessitating the presence of a "shunter" between the trucks or coaches. Each vehicle is provided with a sort of two-pronged claw hinged under the floor. When two vehicles approach, one claw glides up over the other and interlocks with it. The movement of a lever at the side of the truck sets it free; so that there is no necessity for any one to endanger his life by getting between and from there beneath the trucks. This coupling may be applied to existing apparatus, apparently with an ultimate reduction in the expenditure.

The conviction that our present system of fog-signalling

is positively bad has long since forced itself upon the great majority of travellers. The uncertainty and danger enshrouding them is considerably enhanced in the case of a junction, where a number of trains may be endeavouring to pass simultaneously. The Electric Signal Company exhibit a system by which the ordinary visual signals are repeated on the engine, and as long as the semaphore is set at danger an audible signal, in the shape of an electric bell, is maintained on the engine. The whole of this is effected by making or breaking an electric circuit. The progress of the train along the line is also indicated to the signalman, and the duration of each danger-signal is automatically recorded.

Messrs. Mackenzie & Holland, Messrs. Saxby & Farmer, Mr. W. R. Sykes, and others, make together an excellent show of interlocking and blocking apparatus, which are worthy of considerable attention.

The working railways on the south promenade are being pushed forward into a state of preparedness—indeed, that worked by the British Mekarski Company is practically complete, and but little more is required to be done on Mr. Holroyd's Smith electric railway.

These remarks can scarcely be concluded without a reference being made to the steam locomotives for street tramways. Messrs. Merryweather & Sons exhibit a well-finished specimen of the type of engine in use on the North London Tramways, which is specially adapted to steep gradients, is free from noise either of blast or machinery, is smokeless, and effectually condenses the exhaust steam. This firm, who were the pioneers in the adoption of steam motors for tramways, have engines at work in Australia, New Zealand, India, France, Spain, Germany, Holland, &c. It is said that the cost for four years' working on the Stockton and Darlington line was at the rate 3·12d. per mile, while seven years' working on the Dewsbury, Batley, and Birstal line showed an average cost 2·57d. per mile, or about half that of horse-traction. It is further urged that the result of experience on the North London line is to confirm the impression that these engines are not a source of terror to horses even in a busy thoroughfare.

The Falcon Engine and Car Works turn out a sample of the Falcon Engine, which is used at Birmingham, Coventry, Manchester, Bury, Oldham, and elsewhere. Another tram-locomotive is shown by Messrs. Black, Hawthorn, & Co., of Gateshead.

Altogether, a deal is to be seen and a deal to be learned from an inspection of the railway plant exhibited in the Centre Court of the South Galleries at the Inventions Exhibition.

THE EVOLUTION OF THE SENSE OF BEAUTY.

By CONSTANCE C. W. NADEN.

(*Continued from page* 415.)

THE formation of the Greek ideal, or of any ideal, presents an interesting problem. How did it grow? What was the manner of its evolution? No one now imagines that the sculptor took a nose here and a mouth there, from one model a leg and from another an arm, and combined such *disjecta membra* into a complete body. Nor is it generally supposed that prior to all experience he carried in his mind an Archetype, which enabled him to outdo Nature, and to reveal the true design of her imperfect work.

A solution of the problem is suggested by a very modern invention. Mr. Galton's method of composite photography gives us the clue to the evolution of Greek art.*

A number of portraits are selected, similar in size and attitude, and having the same general type of physiognomy, although the individual differences may be many and marked. Their images are thrown in rapid succession upon the same portion of the same sensitised photographic plate, and the result is a *generic* portrait—like all, yet bearing exact resemblance to none. Individual peculiarities disappear, and only the lines common to all, or to most, are preserved. But this typical face is almost invariably far more beautiful than any of the faces from which it is composed. A composite taken from five portraits of Cleopatra is described as being, "as usual, better-looking than any of the components, none of which, however, give any indication of her reputed beauty." Family portraits, compounded of old and young, male and female, are in most cases "flatteringly handsome."

Mr. Galton points out that the generic portrait is strikingly analogous to a mental concept, and that the formation of the one may help to explain the formation of the other. The brain of the observer may be regarded as a sensitised plate—weakly sensitised in the ordinary man, strongly sensitised in the artist. The plate, or brain, receives a number of superimposed impressions; those which are in some degree similar blend and coalesce, the lines which coincide being strengthened, while those which deviate widely tend to fade away. What remains is the pure type, which may be the portrait of a race, a class, or a family. Though perhaps never seen in real life, it is abidingly present to the mind's eye, and becomes a standard by which real life is judged.

The analogy (as Mr. Galton himself remarks) is not perfect. The mind does not always distinguish between superficial and essential resemblance; and even when it has been trained to such discrimination, there is another important source of error. A single picture displayed ten times as long as any of the others would produce on the sensitised plate an effect ten times as great; but this is not always true of brain-images. The impression produced by the more common outlines does not increase in the ratio of their frequency, and therefore is not sufficiently strong to overpower the impression produced by outlines which are less common. Extreme forms will, therefore, leave very visible traces. However, this flaw in our analogy really only makes the explanation more complete; for it is noticeable that all art tends to exaggerate the distinctive features of its ideal. Indeed, the natural craving for variety and intensity carries art even beyond the boundary of actually-existing shapes. The facial angle of the Greek type—as remarked by Herbert Spencer—is larger than we ever find it in nature, the cheek-bones smaller, the nose straighter.

But why does the generic image appear beautiful? Mr. Galton ascribes its beauty to the smoothing away of individual irregularities; but this obviously is a mere re-statement of the facts, not an answer to the question. We must look a little deeper for our reply.

Impressions of every kind are received by the artist, as by the ordinary observer, and unconsciously combined into generic ideas. Wisdom, power, love, and majesty—these abstractions, produced by the synthesis of many concrete experiences, dwell in the mind, and crave for embodiment. They ask to be born into the visible world.

But, clearly, the best incarnation of Power must be the compound image of many strong men, the best incarnation

* See Mr. Galton's "Researches into Human Faculty"; also an article on "Generic Images," *Nineteenth Century*, March, 1879.

of Love must be the compound image of many attractive and lovable women. Wisdom will be symbolised by the ideal portrait of a sage, and divine majesty by the union of those outward attributes which mark the born kings of men. And since the qualities to be thus represented are such as have been gained through ages of evolution, and are therefore advantageous to the race, their physical correlates will be proportionately valued; till at last the reason for admiration is forgotten, and prosaic utilitarianism merges into æsthetic adoration. Yet the incarnation must never lose its soul, and degenerate into simple fleshliness: the more perfect the symbol, the more perfect the beauty.

With Christianity comes the gradual development of a more spiritual and emotional character, not to be typified save by the manifold expressiveness of painting. It would be out of my province to attempt even a sketch of the progress of Christian art, from the stiff outlines in the Catacombs, to the awaking, but still fettered, genius of Cimabue and Giotto, and the full freedom of Michelangelo and Raphael. But it is Raphael's glory that he has satisfied the three demands which the human soul addresses to its artistic ministers; he has stimulated the eye by rich colour and contrast of light and shade; he has gratified the love of life by his healthful mothers and chubby infants; he has responded to the emotional instinct by suggestions of tender human feeling in his Madonnas, and of rapt ideal devotion in his wondrous St. Cecilia.

I need say little about the taste for the "picturesque" and the rise of the landscape art, since here I fully agree with Mr. Grant Allen.* He points out that the primitive love of beauty is never evoked except by an object more or less closely connected with some physical need. The bird concentrates its attention on its own species, and does not trouble itself, so far as we know, about the unpractical beauties of sky and sea. Primitive man takes the liveliest interest in the decoration of his weapons and tools, and in those natural objects which he can use as ornaments for his person; then he begins to take pride in adorning the home, the palace, and the temple; when he cultivates the ground, his orchard and garden are pleasing in his eyes; and, finally, when travel has become easy, and the mountain, the precipice, the ravine, the glacier, the forest, the sea, are no longer symbols of weariness and terror, of cold and hunger, of long toilsome journeys amid savage tribes, he at last feels a free and fearless pleasure in the lines and lights and hues of landscape and seascape.

If I have succeeded in nothing else, I think I have at least indicated the difficulty and complication of my subject. Our ideal of beauty has not been miraculously cast down from the skies as a golden image to be worshipped for ever and ever. It is a growing organism, sprung from simple germs, always evolving into more complex forms, varying, like all organisms, with its position in time and space, and with all the conditions which surround it. Every change in climate, in custom, in morality, in government, in religion, has left its trace on this sensitive part of our nature. There is no warrior, no ruler, no anarchist, no saint, no philosopher, no man of science, who has not, consciously or unconsciously, influenced its growth. Not a need, or emotion, or illusion, but has helped to mould the private and public ideal.

The very intolerance which makes the æsthetic reformer pose as a prophet, and deliver the burden of the Lord against his fellows, may often be a sign or a source of strength; the very tolerance with which the eclectic art-critic admits the merits of all styles and schools, may be only the last flower of weakness. Yet there should be times when the veriest specialist in art looks up from his own little valley, and, beholding the mountains which surround it, dimly believes that from its heights may be seen rivers and plains and seas, and a broader heaven.

* "Æsthetic Evolution in Man" (*Mind*, October, 1880).

THE ORIGIN AND HOME OF THE DIAMOND.

By W. Jerome Harrison, F.G.S.

THE DIAMOND IN SOUTH AFRICA.

In the year 1867, the news that diamonds had been discovered in South Africa was received in Europe with much surprise and some incredulity. The site of the first diamond-diggings was in the gravel deposited by the River Vaal along its course in Griqualand West, not far from its junction with the Orange River. The richness of these "river diggings," with the good quality and size of the stones, soon attracted hordes of miners, who traced the diamond-bearing gravels along about 200 miles of the course of the Vaal. But in the river-gravels the diamond is clearly but a "lodger"; it lies with the countless other pebbles, of all sorts and sizes, all swept away from their parent rocks by rain and frost and the current of the stream. Men reasoned that if the precious stone was so plentiful in these gravels, its true home—the rock in which it was formed—could not be far off, and they searched the country round with a keenness which deserved to be, and which was, richly rewarded.

By the year 1871 four points—Du Toit's Pan, De Beers, Bultfontein, and Kimberley—had been discovered where diamonds were found in the solid rock. These four diamond-mines—or "dry diggings," as they are called, in contradiction to the "river diggings"—lay close together about 24 miles south of the River Vaal. They are 550 miles north-east of Cape Town, and 350 miles west of D'Urban (Port Natal). Two other mines have since been found at Koffy Fontein and Jager's Fontein, about fifty miles east of Kimberley, in the Orange Free State. So vigorously has the search been conducted, and so numerous have been the "finds," that diamonds to the estimated value of thirty million pounds sterling have already been obtained from these South African mines. This great influx of precious stones from a British colony has led to the introduction of diamond-cutting as an English industry, and the diamond-cutters of Clerkenwell are now considered fully equal in skill to those of Amsterdam.

To understand the mode of occurrence of the diamond in its matrix, we must briefly describe the geology of the country. Commencing on the west coast at Port Nolloth, an ancient rock, called gneiss, forms the surface for 300 miles as we walk eastward. It is then overlain by metamorphic schists; and above these, forming a level plateau 5,000 ft. above sea-level, come the Kimberley shales. These shales vary from blue to black in colour, are of considerable thickness, and appear to have been deposited in the bed of a large lake or lakes, resembling those which now occur in Central Africa. Fossil ferns and thin seams of coal are common in the shales, whose precise geological age is uncertain, although the probabilities are that they belong to the period of the Trias or New Red Sandstone. At some period after their formation, the consolidated hardened muds or shales were invaded by melted rocks, forced up from below, doubtless by the agency of steam, which is now known to play the principal part in volcanic disturbances. These igneous or fire-formed rocks traverse the shales as flat

sheets which have been injected, as it were, between the strata, and as more or less vertical walls or dykes; in composition they closely resemble the ordinary "trap" or basalt, such as forms the "Great Whin Sill" of Northumberland, and the Rowley Hills, near Dudley. It is needless to say that the hot rock has affected the shales in its immediate vicinity; they are hardened, and the coal is converted into stone-coal or anthracite.

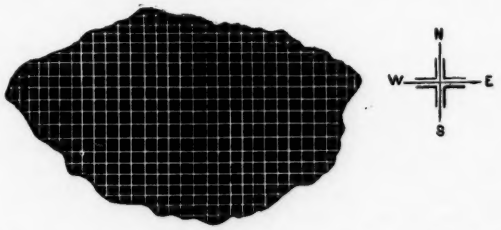

Fig. 1.—Showing the 400 "claims" into which the surface of the Kimberley Diamond Mine was originally divided.

But the diamonds do not occur in either the trap-rocks or the shales; they are confined to certain vertical pipes or "necks," which are believed to be the channels of communication by which melted matter rose from below to volcanic craters now swept away. We will describe the Kimberley mine as a type of the rest. All over the surface of the level plains of Griqualand red sand is spread to a depth of from two or three inches to as many feet; below this comes a tufaceous limestone (a deposit extracted by the influences of the weather from the rocks below) of similar thickness, and below the limestone we find either shale or trap-rock, or, if we are lucky enough to hit

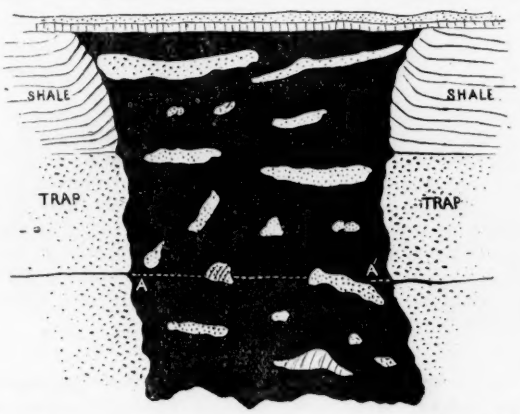

Fig. 2.—Vertical section of the Kimberley Diamond Mine, showing the different rocks passed through. The dotted line A A' marks the present level of the workings.

upon it, the diamantiferous rock itself. At Kimberley, formerly known first as "New Rush" and then as Colesberg Kopje, the old crater-neck occupies an oval area of about twelve acres, which has been excavated to a depth of 450 ft. The walls, or sides, of this enormous hole are composed partly of shale—bent upwards near its contact with the diamond rock—and partly of trap. As the mine deepens, the sides frequently fall in, and great trouble has recently been experienced from this cause. The material filling the pipe, and containing the diamonds, is of an extraordinary and heterogeneous nature. The matrix is a greenish mineral called bronzite (a hydrated silicate of magnesia), but it includes thousands of rock-fragments.

The shales, the trap-rocks, other rocks such as gneiss, which do not crop out at the surface in this region, all these occur in the pipe in masses of every conceivable size, form, and shape. The whole points irresistibly to the conclusion that the bronzite was forced up from below in a melted state, and that it has broken through, incorporated, and carried upwards fragments of all the rocks through which it has passed.

The diamonds are found embedded in the greenish matrix. They are crystallised in the octahedral form, or in one of its derivatives. They are frequently found broken or fragmentary, or even as mere splinters (for the diamond is a rather brittle stone), but the missing fragments of any one stone are never found, although they have been diligently looked for.

Kimberley Mine, with its neighbours, was annexed by the British Government, in the interests of order, in 1871. It is divided into 400 claims, each 10 yards square, on each of which a Government royalty of 10s. per month has to be paid. As the stuff is excavated, it is drawn up by steam-power, along wire ropes, to the surface. Here it is washed and sifted by machinery, the residue being lastly passed over the sorting-tables, where the diamonds are picked out. Owing to the large scale on which the operations have now to be conducted, most of the claims are united into companies. The following extracts from the balance-sheet of the "Central Diamond-mining Company," Kimberley, for the year ending May, 1883, will give some idea of the scale of work and the profits.

Quantity of diamond-rock that has been hauled up = 344,205 loads, 16 cubic feet each.

Quantity of diamonds found = 471,488 carats.
Quantity of diamonds sold = 434,890 carats.
Value of diamonds sold = £482,314.

Value of plant at the mine = £98,871.
Expenses of working = £253,920.
Paid for rates and licences = £147,709.

Amount paid as dividend = £100,951.

It will be seen that the rough diamonds were sold at the rate of about one guinea per carat, but this would include much "bort," as the diamonds which are useless for ornamental purposes are called. A cut brilliant of good quality, weighing one carat, is sold by jewellers at from £8 to £10, and above this weight the value increases *as the square* of the weight in carats. Thus a diamond of the "first" water, weighing ten carats, is theoretically valued at $10 \times 10 \times £10 = £1,000$. The largest diamond hitherto found in South Africa is the "Stewart," which weighs 288 carats (about 2 ounces troy); but the "Star of South Africa," 83½ carats, and the "Porter-Rhodes" are also very fine gems. Many of the stones have a pale yellow tinge, but others are quite equal to the best specimens ever obtained from India or Brazil.

(To be continued.)

AMONGST the most recent applications of the Æolus Water-spray System of Ventilation are those at the New Registry-room, G.P.O.; St. John's Church, Waterloo-bridge-road, S.E.; Dr. Voysey's Church, Swallow-street, Piccadilly; "Greenlands," the seat of Right Hon. W. H. Smith, M.P., Henley-on-Thames; St. John's Church, Gainsborough; Buckfastleigh Abbey, Devonshire; St. Mary's College, Wolverhampton; Hospital, Singapore; *New Daily Press* Offices, Bristol; Dr. Sharp's, Curzon-street, Mayfair, W.; Highfield Chapel, Earlsheaton; New Butcher's Hall, Bartholomew-close; Christ Church (Congregational), Rhyl; Portland Prison; Parkhurst Prison; Hindlip Church, Worcester; West Ham Police-court; Chapel of St. Bartholomew; Convalescent Home, Swanley; and Oldham-street shops, Manchester (third order).

Editorial Gossip.

I have received a pamphlet from Colonel Parnell (late R.E.), being a reprint of a paper read by him before the Royal Meteorological Society, which contains matter at once novel and interesting. It is "On the Mechanical Characteristics of Lightning Strokes," and deals with the results of observation of 923 cases in which lightning struck various bodies, animate and inanimate. Colonel Parnell combats the commonly-received idea that lightning descends from the clouds to strike houses, trees, and people, and contends that, on the contrary, in a very large number of instances, it passes out of the earth through the body "struck." The evidence he adduces must be sought in his own pamphlet. Speaking for myself, I am inclined to credit it, not only from its intrinsic force, but because (*pace* Professor Tait) I have myself distinctly seen lightning strike *upwards*.

Amid the opprobria of English jurisprudence, the existing law of libel seems to me to hold a prominent place; in fact, the entire abolition of civil actions for it would appear to be imperatively called for. That any *Gentleman* should seek to make money under pretence of salving his wounded honour and credit, it is monstrous to suppose; but unfortunately actions for damages, are, in the overwhelming majority of cases, not instituted by people with any claim (save an empty statutable one) to be so described. For, sooth to say, libel suits are, in ninety-nine cases out of a hundred, merely "attorneys' actions" brought for the sake of the costs, and nothing else; and many a man will put up with an almost indefinite amount of vilification from another out of whom no costs are to be had, who would promptly enough attempt to exact reparation from anybody from whom money was to be extorted.

I have been led into this train of thought by seeing that a Mr. Legge, who a short time ago brought an action against the *World* for libel—and lost it—has been figuring in the Bankruptcy Court; and by the reminiscence which this induced of the termination of the notorious case of Belt *v.* Lawes, after a similar fashion.

Now, it is positively scandalous that a man who may be actuated merely by a wish to advertise himself, by personal rancour, conceit, or by a dozen other equally worthy motives, should be able to drag any one into court and subject him to the pains and penalties of a long and most costly trial, and then, when the verdict goes against himself, quietly to become bankrupt, leaving the victim of his (judge-and-jury declared) unjust action saddled with enormous costs.

The remedy for such a state of things is obvious. Pending the speedy and entire abolition of civil actions for libel, no one should be suffered to bring such an action without first finding security for the whole of the costs. This abolition accomplished, then a slight modification of the 44 and 45 Vict., c. 60 (with the special retention of s. 3 of that Act), would enable every really-aggrieved person to obtain a remedy, and to vindicate his unjustifiably-assailed reputation promptly and effectually.

The dignity of a baronet is just 274 years old to-day; for on May 22, 1611, that slobbering pedant James I. made his first batch of them. The king was very hard-up, and as these initial holders of peerages-and-water had to pay him £1,000 each for their aggrandisement, he contrived to raise a by no means inconsiderable sum by selling his bran new titles. Time has now cast its halo over them, and the Order of Baronetcy has at least as much lustre shed upon it by some of its members as it confers upon them, and commands an amount of respect and deference which it scarcely obtained when admission could be gained to it, as to a show, by payment at the doors.

Under various statutes, beginning with 10 and 11 Wm. III. c. 17, and culminating in 42 Geo. III. c. 119, lotteries are declared to be public nuisances. A penalty of £500 is imposed on every one who exercises or opens a lottery; a similar penalty upon any person who knowingly suffers his house or room to be used for the purposes of a lottery; and also a penalty of £20 upon every person who shall play, throw, or draw at any lottery. Nor are these Acts merely a dead letter, for not many years ago a certain conjuring "Professor" at Brighton found himself inside Lewes Gaol for distributing some articles of jewellery by lot at one of his entertainments. Exhibiting such care as this for the morals and safety of the inhabitants of these islands, it might reasonably be expected that our paternal Government would itself studiously avoid giving any facilities in the United Kingdom for what it is so ready to punish in a highly-penal fashion; and yet there are perpetually passing through the General Post-office by book-post, and open to the inspection of every one through whose hands they may pass, thousands of circulars from Jews (calling themselves "bankers") in Hamburg, inviting people to take shares in a "great money lottery under the Government guarantee." The whole thing approaches so closely to a swindle that it is infinitely discreditable to our postal authorities that these circulars are not all returned to the senders. That the chance bought by the confiding idiot who returns a pecuniary reply to any of these gull-traps refers only to *one* of the "classes" of drawing set forth in them, is never even hinted at. Hence the odds against his winning anything whatever are overwhelming, even supposing that the whole thing were fair and above board. As it is, it is, I must repeat, infinitely discreditable that the authorities at St. Martin's-le-Grand do not summarily suppress the circulation of these announcements at once and for ever. They cannot plead the excuse that they are ignorant of the nature of them, inasmuch as—as I have previously said—they are open to the inspection of every one.

An announcement in the newspapers, under the heading of "Deaths," seems to snap a curious link with an almost historical past:—

> Shelley.—May 10th, at Tandridge Court, Godstone, Surrey, Hellen Shelley, daughter of Sir Timothy Shelley, Bart.; born Sept. 29, 1799.

This was the sister "Hellen" of that *bête noire* of our grandfathers and grandmothers, Percy Bysshe Shelley, the poet, who was drowned in the bay of Spezzia just sixty-three years ago. Strange it seemed to see this lamented lady moving in society within the last few months, or even weeks, and to think of her immediate personal connection with a past so utterly dead and buried to the present generation. The beau-ideal of a high-bred Englishwoman, she, clad in dark velvet and lace, looked as though she had just stepped out of one of Kneller's frames. She was reticent about "Bysshe" (as she always called her brother), and never cared to talk of him.

Reviews.

SOME BOOKS ON OUR TABLE.

The Fallacy of the Present Theory of Sound. By HENRY A. MOLT, Jun., PhD., &c. (New York: Wiley & Sons. London: Trübner & Co. 1885.)—There is no acousticist but Hall, and Molt is his prophet, is the burden of this queer book. Blaserna, Helmholtz, Mayer, Lord Rayleigh, Rood, Sir William Thomson, and Tyndall, to take some names mentioned by our author, can only "retain the respect and confidence of all thinking people" by giving up straightway the theory that sound is an effect of atmospheric undulations. Not a bit of it! So far as we can understand Dr. Molt (and he is not, perhaps, always quite so lucid and intelligible as he might be), air has nothing to do with conveying sound, and the stupid people who fancy that a bell rung in an exhausted receiver is inaudible—*ought* to hear it, that's all. Further (again with the same qualification) it would seem as though Messrs. Hall, Molt, & Co. conceive that a given particle of air must proceed from the immediate neighbourhood of the sounding body, at the rate of 1,120 ft. per second, straight to the recipient tympanum, if the existing theory be correct. Wave motion seems a hopeless puzzle to our author. He is described on his title-page as "Professor of Chemistry and Physics to the New York Medical College and Hospital for Women." We can only congratulate ourselves upon the fact that we are deprived by the wrongs of our sex from receiving instruction in such "physics" in that doubtless otherwise valuable institution.

The Elements of Inorganic Chemistry. Part II. (Advanced Stage.) By J. C. BUCKMASTER. New Edition; revised in 1884. (London: Moffatt & Paige.)—Avowedly compiled in accordance with the requirements of the syllabus issued by the Science and Art Department, Mr. Buckmaster's small volume will be found useful by students cramming to pass the examination at South Kensington. In other respects, it is neither better nor worse than half-a-dozen "Elements," "Manuals," and "Handbooks" that we could name.

The Science of Change of Air. By DAVID S. SKINNER, M.D. (London: Tinsley Brothers. 1885.)—In this pamphlet the author treats in his exordium of physiology, and of the corporeal conditions under which change of air is beneficial and requisite; and after dealing with the questions of atmospheric pressure, the watery vapour of the breath, ozone, and electricity, concludes with some meteorological statistics of certain English health-resorts. The reader who may wish to learn whether, in his own case, a visit to any of these is likely to prove beneficial, should procure Dr. Skinner's *brochure.*

Rus: a Bundle of Bucolics.—(London: Wyman & Sons. 1885.)—When, by dint of long pestering, the old woman at last got her minister to pray for rain, and a hail-storm came and cut up all her cabbages, she is reported to have exclaimed: "Oh dear! that's just like Mr. Jones—he always *overdoes* everything!" We may reiterate this historical complaint with reference to the author of the little book before us. He overdoes everything. In a series of short and really clever essays, descriptive of English country life and functions generally, he attacks the land-laws in a spirit worthy of Mr. George himself; but to those really familiar with the social conditions of the agricultural districts, his exaggeration will defeat its own end by setting his readers against him, and blinding their eyes to truths which may be not unprofitably learned from his pages. Peers are not all *ex necessitate*, idle and capricious idiots; squires, not all fat, pompous, and underbred; nor any but the merest insignificant fraction of poachers—young men "with a manly spirit and an empty body, tired of bread and lard," who, one evening, on their way from work, knock down rabbits in their path and take them home to eat. While, again, this sentence: "When the 'just laws' are invoked against the labourer by the squire or parson, those laws are administered by magistrates who are the interested friends and neighbours of that squire and parson, *often acting on information privately supplied by the good squire himself*" (and notably the words we have italicised) is so grossly and libellously false that we can come but to one of two conclusions—either that the writer penned them in total ignorance, or in a spiteful and deliberate attempt to deceive urban dwellers. There are good and bad peers, parsons, and squires, just as there are conscientious demagogues, side by side with spouters who, for their own ends, scream for riot, rebellion, and the seizure of property that they themselves never had the providence to acquire. The concluding chapter may be read with advantage by all who wish to know the sort of vermin who are being sheltered by our "Cousins" across the Atlantic. "Forewarned is forearmed," and the sooner the gallows bears an abundant crop of "Smiths," the happier for the world at large.

Illustrated Catalogue of the Royal Society of Painters in Water-Colours. (London: T. Fisher Unwin. 1885.)—The excellent example, originally, we believe, set by Mr. Henry Blackburn in his "Academy Notes," of supplying sketches of all the notable pictures of the year, has been followed by the Royal Society of Painters in Water-Colours in their official catalogue. How pleasant a reminiscence of an exhibition such sketches afford it is needless to say here, for surely no one who can obtain such vivid reminders of notable works of art as those contained in some of the pages before us will ever be satisfied again with a bald list of titles and artists' names. No inconsiderable portion of these clever little pictures are well worth preserving, even by those who may never have seen the originals at all.

Advanced Studies of Flower-Painting in Water Colours. By ADA HANBURY, and other Artists. (London: Blackie & Son. 1885.)—The reader who, by the use of the "Simple Lessons in Flower-Painting," published in Vere Foster's series (to which the present work belongs) has acquired a certain amount of rudimentary technical knowledge, should proceed to the study of Miss Hanbury's very beautiful volume if he or she desires to attain proficiency in the charming art of flower-painting. The authoress commences with a section on the choice of materials and method of work, followed by one on the botanical terms employed, as is that in turn by disquisitions on flower-painting from nature generally, composition, and grouping. And then we come to the principal part of her work, consisting of twelve fac-simile coloured sketches of flowers (which it is literally no exaggeration to term exquisite), with full and explicit direction for copying them. Outline drawings, too, of the various flowers delineated are scattered through the text. Whether we view the work before us as an efficient tutor in a delightful branch of art, or merely as a perennial ornament to the drawing-room table, it has our heartiest commendation.

We have also on our table *The American Naturalist, The Sanitary News, The Journal of Botany, The Christian Million, The Tricyclist, Wheeling, Society, The Medical Press and Circular, The Lancet, The Report of the Committee of Management of the Technological, Industrial, and Sanitary Museum of New South Wales, The Country Brewers' Gazette, The American Druggist, The Proceedings of the Geological Society,* and *Parallax.*

THE FACE OF THE SKY.

From May 22 to June 5.

By F.R.A.S.

THE Sun should still be examined on every clear day, as spots and faculæ continue to appear. Maps V. and VI. of "The Stars in their Seasons" exhibit the aspect of the night sky. There will, by the way, be no real night in any portion of the United Kingdom during the next fortnight, as twilight persists from sunset to sunrise. Mercury is a morning star, but is indifferently placed for the observer, as although he attains his greatest western elongation (24° 45′) on the 25th, he even then rises almost in broad daylight. Venus, in the sense of southing after the Sun, is an evening star, but is too close to him to be visible to the amateur for whom these notes are intended. Mars, Saturn, and Neptune are invisible, for cognate reasons. Jupiter is rapidly approaching the west, and should be viewed as soon as he is fairly visible. The twilight, and his approach to the western horizon, render the observation of many of the phenomena of his Satellites very doubtful. Of such phenomena the following will happen during the succeeding fourteen days. To night (22nd) the shadow of Satellite IV. will pass off Jupiter's disc at 10h. 4m., and Satellite I. will reappear from eclipse at 10h. 22m. 55s. On the 26th Satellite II. will begin its transit in bright twilight at 8h. 10m., and at 10h. 41m. its shadow will follow it. The Satellite itself will quit Jupiter's opposite limb at 11h. 6m. On the 27th Satellite III. will be occulted at 9h. 57m. On the 28th Satellite II. will reappear from eclipse at 8h. 39m. 13s., and the transit of Satellite I. begin at 11h. 37m. On the 29th Satellite I. will be occulted at 8h. 46m. and reappear from eclipse 18h. 3m. after midnight. It is questionable how far either of these phenomena will be fairly observable—a remark which may be extended to the egress of Satellite I. at 8h. 25m., and the reappearance of Satellite IV. from occultation at 8h. 56m. on the 30th. The egress of the shadow of the first satellite will occur at 9h. 40m. It may be doubted whether the egress of the shadow of Satellite III. will be fairly seen at 8h. 36m. on the 31st. On June 2 the transit of Satellite II. will begin at 10h. 50m., and on June 4 the same Satellite will reappear from eclipse at 11h. 14m. 19s. Finally, on June 5, Satellite I. will be occultated at 10h. 43m. Uranus may still be seen to the west of η Virginis. The Moon is full at 8h. 30m. 9s. p.m. on the 28th, and enters her first quarter 4·8 minutes after midnight on June 5. No occultations visible during the working hours of the night occur during the period covered by these notes. The Moon is in Leo when they begin, but passes into Virgo at midnight. It is not until 5h. 30m. a.m. on the 26th that she has completed her passage across this constellation and passed into Libra. In her passage through Libra she, at 6h. a.m. on the 28th, arrives at the boundary of the narrow northern strip of Scorpio, which, at 4 o'clock the same afternoon, she quits for Ophiuchus, from which, at 2h. p.m. on the 30th, she enters Sagittarius. At 4h. a.m. on June 2 she crosses into Capricornus, which in turn she quits for Aquarius at midnight on the same day. She is in Aquarius up to midnight of June 5.

"Where to find ferns?" is a question that will be answered by pictures as well as by words in a cheap little volume by Mr. Francis George Heath, to be published immediately by the Society for Promoting Christian Knowledge. The book will include, besides drawings of the ferns described, the novel feature of illustrations of fern habitats.

Royal Victoria Hall (Waterloo-road).—On Tuesday, the 12th inst., Dr. Dallinger gave a lecture at this hall on "Things we don't see; or, What the Microscope shows us." The lantern illustrations were drawings of extreme beauty, taken through the microscope by the lecturer himself. The point of the lecture was that beauty is as universal and as marvellous in the smallest natural objects as in the largest. Beginning with comparatively large and familiar objects, the lecturer threw on the screen drawings of a spider's foot, a flea, a mosquito's sting, and a wasp's sting, showing in each case how higher magnifying power revealed greater detail and greater beauty. In contrast with the wasp's sting was shown the jagged, poker-like outline of the point of a very fine needle, proving how unfit manufactured articles were to stand the same test. Eggs of minute insects were then shown, and organisms invisible to the naked eye, such as the fine powder to which Barbadoes chalk is reduced by boiling in acid. These grains of powder were many of them shaped like elaborately-carved crowns and crosses. In conclusion, the bacteria of putrid water were shown, of which fifty million can swim easily in a space no bigger than a pin's head, and an account was given of the method by which their size is measured.

"Let Knowledge grow from more to more."—Alfred Tennyson.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

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THOUGHT-READING.

[1710]—History repeats itself; and the record of human superstition in the remote past is not without its parallel in these days of so-called enlightenment.

Why should we ignore the fact? The doctrine of transmigration has again taken root in European soil, and is really quite a thriving plant. Sceptics, indeed, talk about bunkum being the order of the day, and there are not wanting hints that plants of the fungoid type may be known by their early maturity, habitat, and physical characters; but the true believer cherishes none the less the conviction that the phenomena of thought-reading are of a spiritual nature, and capable only of a spiritual interpretation.

Doubtless they scoff in turn at the old notion of the human soul playing its part in the life-history of an animal which it most resembled while in the flesh, but they seem to find no obstacle to the belief that this may take place during life between individuals who happen to have an *affinity* to one another.

For example, the soul A (or a part of it) enters the mortal tenement of B, and holds friendly intercourse with the same, the result being that B communicates to A the whereabouts of a pin, the letters of a name, or some such trifle which may have come within the sphere of its observation. A (or its process) then wings its way back to its house of clay and proves the accuracy of its knowledge by finding the pin or writing the word. And so on.

We do not question the accuracy of the results which have been witnessed at the "thought-reading" *séances* so familiar to every one. To cavil at facts because they are strange is, it need hardly be said, as injurious to the growth of true knowledge as to expose a tender seedling to the burning rays of the noontide sun; and that in the greater number of instances we are dealing with facts cannot be doubted by any one who chooses to examine the phenomena of thought-reading in the spirit of sober and unprejudiced criticism.

But while the *fact* stands out clear and decided, we are open to entertain any *theory* which to our mind may best accord itself with the results obtained, and the question therefore arises, Is the foregoing explanation the only feasible one? Is there an actual transmission from the "medium" to the oracle of an entity called thought, or is some other vehicle employed to convey the desired information?

In attempting to answer this question, we bring under notice two theories, each of which aims at supplying us with a rational explanation of the facts in question.

One we may call the fluid theory, the other is known as the muscle-reading theory.

The former labours under one of the disadvantages of the spiritual hypothesis in supposing the results to be due to the action of an agent the existence of which as a separate factor has been anything but proved. On the one hand, the agent is the faculty of thought; on the other, it goes by the somewhat fanciful name of the Odic or Psychic force, which is supposed to resemble electricity in some degree, and to be collected in the great ganglia of the body, from whence it passes along the nerves to the surface of the body, and finally may enter the system of another individual, producing changes in his conscious states.

The production of mesmerism, or artificial sleep-walking, by gazing into the eyes of the *subject* and gently fanning his face with the hands, is thus ascribed to this agent, and at one time we held

this view; but it is no longer tenable, as the evidence in favour of its existence has gradually been broken down, more exact research having eliminated errors which at first sight passed unnoticed.

The elaborate experiments of Baron Reichenbach—whose "sensitives" were said to *see* this fluid issuing like a lambent display of colour from the tips of the fingers and the surfaces of magnets and crystals, created much astonishment at the time.

But the investigations of Braid and others have proved that the same phenomena may be witnessed in the absence of such bodies if the sensitives be previously led to expect them. Further that the *aura*, as they were called, are quite invisible, even in the presence of these objects, if care be taken to avoid rousing the expectations of the sensitive.

Towards the latter end of 1881 we repeated a form of experiment which had previously been recorded by the late Professor Gregory in his interesting work on "Animal Magnetism."

Three tumblers containing water were placed on a table, and the mesmerised subject, standing at the further end of the room with his back to the table, was carefully watched by some sceptical friends, while we held our hands over one of the tumblers.

After some little time we asked the subject to taste the water contained in each of the tumblers, and to let us know whether he could distinguish any one from the others. He did so, and the result was striking enough; for immediately on tasting the water contained in the "mesmerised" tumbler he selected it as being different from the rest, possessing, he said, a marked flavour which he could not describe.

Repeated trials were not less successful, and the uniformity of the results obtained under varying conditions seemed to justify the belief that something had emanated from our fingers and had manifested itself to the hypnotised subject.

It never once occurred to us that we were dealing with a typical case of thought-reading, and only lately did we make certain that by contriving to remain ignorant as to which tumbler he has "influenced," the operator reduces the results from certainty to mere guess-work.

On the whole, it appears to be tolerably certain that the fluid hypothesis has a very doubtful foundation in fact.

Turning now our attention to the second theory, we shall, as we venture to think, find an explanation of *all* the phenomena which are included in the term "thought-reading."

In the pin-finding experiment we have to deal with muscle-reading in its simplest form, direct contact existing between the medium and the pin-finder.

As the sprightly gyrations of the table were proved by Faraday to be due to involuntary muscular contractions in the hands of persons seated or standing around it—so the mighty pin-hunter in search of his prey is urged on in the right track by the unconscious exertions of his medium. We have tried this sort of thing, and have always found that the right direction is the *direction of least resistance*. With a little practice, the pin-hunter soon learns to appreciate the efforts which are being made to keep him in the pin-path. This, of course, may take place without conscious effort, just as the sleep-walker learns to avoid obstacles with which he may be brought in contact during his nocturnal wanderings.

Coming now to that more difficult class of cases where no contact exists between the oracle and his medium, we find that the same principle prevails. Direct contact there is not, but it is still possible, through the agency of senses other than those of touch and effort, to glean information as to the thoughts of others. The sense of sight, happily named by Herbert Spencer the "anticipatory touch," together with the senses of hearing and smell, may become the gateways of our knowledge as to the thoughts of others.

On the one hand we have the "oracle" trying hard "to make his mind a blank," and thus by checking the outflow of ideas rendering himself more sensitive to impressions from without. On the other we have the medium or mediums, their whole attention concentrated on the form of task which has been agreed upon in the absence of the "oracle," and which they are resolved he shall carry out. In at least four cases out of five he does so if practice has made him at all proficient. And why?

The lower animals communicate their ideas and emotions to one another mainly by muscular signals or gestures, and although this faculty has to a great extent become latent in man, as his more varied ideas require a more varied outlet of expression—namely, language—nevertheless they, and more especially our emotions, find utterance in unspoken signs.

With regard to the latter, Dr. Maudsley has observed that "the special muscular action is not merely an exponent of the passion, but an essential part of it," and Darwin held a similar view. Spencer, indeed, in this connection has attempted to show the *rationale* of these muscular contractions. In describing the passion of anger, he says that it is seen "in a general tension of the muscular system, in gnashing of teeth and protrusion of claws, in dilated eyes and nostrils, in growls; and these are weak forms of the actions which accompany the killing of prey."

Whether this remark is capable of a still wider interpretation we cannot now stop to inquire. The fact stands out clear and decided that we are able in great measure to express our ideas and emotions to one another by means of muscular symbols.

John Bulwer, a writer of the seventeenth century, expressed his opinion that "the lineaments of the body doe disclose the disposition and inclination of the minde in generall; but the motions doe not only so, but doe further disclose the present humour and state of the minde and will, for as the tongue speaketh to the eare, so gesture speaketh to the eye." Again, in addressing himself to deaf mutes, he says: "What though you cannot expresse your mindes in those verball contrivances of man's invention, yet you want not speech, who have your whole body for a tongue, having a language more natural and significant, which is common to you with us, to wit, gesture; the generall and universall language of human nature." The child, before it has acquired a full command of language, excels the adult in the interpretation of these symbols, but the latter may, through practice, recover this faculty to an astonishing degree.

Many, doubtless, who have taken an active part in these thought-reading *séances*, and others who have witnessed them under conditions which entirely shut out the idea of intentional deceit, will say that the subject of these operations is not conscious of receiving, and consequently acting upon, information derived from others. They may even argue that knowledge is *not* derived from any such source, for how can a man know that of which he is not conscious?

The objection, however, is quite superficial. We do not contend that consciousness *is* involved—indeed, our existing knowledge of mind in the lower animals (if that can be called knowledge which is derived from a comparison of objective phenomena in lower grades of life with those which accompany our own physical states) makes it probable that muscular groups for appropriate signalling by gesture were developed in connection with our ideas before the ancestors of mankind were shaped by *circumstance* into the present form, and, consequently, before the embryo thought struggled into conscious activity. We should not, then, expect to find an inseparable connection between "idio-motor" action and consciousness, but rather the reverse. And we should just anticipate what we actually find to be the case. So closely, indeed, are our ideas connected with the mechanism which presides over the movements of our muscles, that various actions are constantly being prompted by them without the intervention of consciousness.

It is very possible, then, that impressions received by the sense organs—so slight in themselves as to be incapable of exciting consciousness in an individual, might be transmitted to the grey matter of the brain, and thereby give rise to "idio-motor" action of the kind just indicated. A physiologist might even be tempted to speak of it as a reflex action, in which case consciousness is still less likely to be involved; but we should be afraid to push the matter so far.

It is, at all events, evident that the above objection would prevent us from entertaining, not this theory only, but any theory which might be put forward to explain the phenomena of thought-reading, for if the knowledge in question were not derived through sense-organs because it did not involve consciousness, neither could it be knowledge if derived from any other source. However, as we have seen, it is not necessary that the thought-reader should have any knowledge of the mental states which impel him to perform the tasks which have been arranged by other minds than his own.

N. GORDON MUNRO.

REAL AND APPARENT BREADTH OF WAVES.

[1711]—In the passage quoted and objected to by "Excelsior" (1696), is it not assumed that in each case the number of waves *actually* passing *the observer* during the 65 seconds is 360, but that his unconscious change of position misleads him as to the space over which they are distributed? While "Excelsior" seems to assume that the number of waves passing the *starting-point* is constant, and consequently that the number seen by the observer must vary when he is in motion.

W. H. G.

"LIFE IN OTHER WORLDS."

[1712]—*Cuique in suâ arte creditur. Ergo*—"if I should rush in where angels," &c., "it is to be feared I shall only," &c. Nevertheless, as a mere juryman, I should maintain that the learned judge has charged against the evidence in two points on p. 258.

1. "The mere continuance, therefore, of processes, which, on the earth, we associate with the existence of life, in reality proves nothing as to the contended existence of life on Mars."

XUM

Now, it is said (*supra*) "The vapour of water is present in [his] atmosphere—clouds form there; snow falls, and perhaps rain, from time to time."

It is reasonable to suppose that if Mars has had a past existence like ours, he has produced a head-race not unlike men. I suppose our globe grown so cold that rain never falls at all anywhere, even then, I think it would be long before we should be extinguished. We are all—wise and unwise—much too apt to infer the impossible from the undone. Mr. W. M. Williams would not admit that I had shown men could probably live naked in cold climates, as Cæsar says the Britains did. Mr. C. Duncombe (1657) quotes Darwin as reporting how the Fuegians actually do so. We would build immense Crystal Palaces, live in them always, only going out for exercise, commerce, and the chase. We should ripen crops under glass, grow vegetables, and fatten cattle under it too. Perhaps ice might prove a most superior substitute for stone; it would let in light and heat-rays, at all events. In the north of Europe many families never leave their habitations all the winter. Beneath the ice on sea, lake, and river, there would still be fish; these we should catch by breaking the ice. Plenty of animals would still be found wild, as they now are in the Arctic regions.

If all this might be, *a fortiori* is it better in Mars. Vapour of water surely proves that his seas are not all frozen; how could it get into the air without water, and a sun hot enough to vaporise that water. Nay, the extensive melting of the polar snows in Mars's summer surely shows that his climate is, on the whole, hotter than our own. I very much question whether any telescope planted in Mars would show, on the earth, any diminution at all in the same regions, same season. His summer being twice as long will, however, give his sun an advantage.

The unique colour of Mars may probably explain this. We are justified in saying that it does not arise from red land or red seas, because we find by the spectroscope no substances, save helium, unknown on earth; hence his land and water must be pretty much like our own. There remains only the air, and the gas mixed therein, which produces the redness of the orb, may be far more heat-conserving than the water which is so rare thereon. It has been shown that water is blue, though we never should have guessed it (a tube of distilled water 16 ft. long when looked through is a beautiful azure), and this surely explains why we enjoy a blue sky. No doubt we look blue to Mars. He has little water in his air, therefore he is not blue; but to make him so very red there must be *something*—not, indeed, unknown here, but whose colour is unknown, as was, till very lately, that of water. It may be oxygen, since this gives redness to the blood. If Mars has a large quantity of it in his air, heat and life must be conserved far more than here.

2. "The once teeming surface of our companion planet."

I do not believe the moon ever has been inhabited, for the following reasons:—

(*a*) She is without the conditions—air and water. Now, we have no example before us of a globe ever having lost these. All the globes we have examined have them—or the first of them, at least. It is impossible that all the lunar seas can have retreated inside, as some say, because, this implying extreme old age, the concomitant cold would freeze a notable part of them before all had percolated away; this part would be vaporised by the fierce fortnight of the lunar day, and become visible to us as clouds. These, of course, would require air to float in; if there ever was air, where is it? The cold of space might freeze it certainly, in the long night; but the day would vaporise it again.

(*b*) If there ever had been rain on the moon, there would be rivers; but there are none. Imagine our globe deprived of air and water. Nothing would be more conspicuous from the moon, in a good telescope, than the beds of the Thames or the Loire; still more the Amazon. A river tapers and meanders, by its nature and her tributaries. There is nothing of the kind in the moon.

(*c*) As in Mars, there would probably have been quasi-human creatures in the moon. But there is no reason to think there ever had been, because there are no traces of human work. Imagine the earth frozen to death, and deprived of air and water; from the moon, with our best telescopes, we should see objects 100 ft. long. The Pyramids, all cities, especially fortress cities, would be distinctly visible to us. Paris, at sunset or sunrise, would be a beautiful polygon, in which we could see Notre Dame as a cross-shaped building. Were we on the moon *now*, we could watch each ship on the sea—publish gazettes of all terrestrial battles. There is no regular work discernible on the moon; *ergo*, &c.

(*d*) The lunar rilles are unlike anything we see on earth. Possibly we have rilles, too, but covered by erosion. Were that so, their visibility on the moon would show that she has never undergone that process of denudation which has created our corn-producing surface.

It may be urged very justly that it is most unlikely there would be a unique globe, never the scene of life. Yes, if the moon sprang off the earth, or the sun. But is it improbable that she was once an independent, errant body, which chanced to pass us near enough to stay for ever? The Arcadians boasted that their fathers were προσέληνοι—had dwelt there before there was a moon. This very extraordinary tradition has been explained by supposing they mistook the original word, which may have been προέλληνες—*i.e.*, before the *Hellenes*. But there is nothing to prove that the lost initial of Ελλην was "s," and why should the other differences have arisen? This suggestion (of the extraneous origin of the moon) is, of course, an extravagant paradox. It has this, however, in its favour. The moon is the only companion planet in the system. Now, it is improbable (*ut supra*) that there should be a *unique* globe. (Which Saturn can hardly be called, because his rings are but discrete satellites, and will some day fall on his globe, according to present observation.)

Hallyards.

THE EVOLUTION OF THE SENSE OF BEAUTY.

[1713]—"S. H." (1700) somewhat misconceives my purpose. The question I have tried to answer is *not*, "How did the colour-sense first arise?" but, "Granted the colour-sense, how did its exercise come to be pleasurable?" However, if we shift the difficulty a step, and, instead of assuming an inchoate sensibility to colour, merely assume that sensibility to *light* which exists in very low forms of life, we may conjecture that light-waves of different lengths would tend to affect the organism differently, and that there would be a corresponding difference in the resulting sensations. At the present stage of our knowledge, it seems impossible to frame even a plausible hypothesis of the evolution of the organs of sense; and (assuming the truth of the Young-Helmholtz theory), I do not pretend to "explain" how the nerve-endings were differentiated for the reception of special kinds of light.

Constance C. W. Naden.

CONCEPTIONS AND IMAGES.

[1714]—"J. S." (1702) cannot possibly know that the independent "something" which causes his sensations in any way resembles the sensations themselves. His "conception" is of the grouped sensations, not of anything "external." C. N.

MATTER REQUIRING REFLECTION.

[1715]—"M. T. H." (letter 1701) does not puzzle me at all. At the moment I am writing, I have opposite to me a looking-glass above a mantelshelf, on which are three glass vases. I am looking at them from the right side; they are reflected in the glass all to the right of each vase, but at exactly the same distance from each other in the glass as they appear from each other on the mantelpiece. Now I go to the left. The reflections appear on the left side now, but the distances from each other in the glass and on the shelf are even then the same exactly. Hence it appears that not the reflection in the glass has changed its position, but I know my position or relation to it has changed. Each vase is reflected true in the glass, *i.e.*, exactly half-way round. If I look from the right I see only the portion reflected to the right; if I look from the left, only the portion reflected to the left side of the vase; if I look straight in front, I see the front half only of my vase, only because it hides the back or reflected half. If I get up and look over my vase I see the true and full reflection in the glass, which common sense tells me must be there, whether I or anybody sees it or not.

F. W. H.

[1716]—Perhaps it will help "M. T. H." (letter 1701) to understand his mirror, if he considers the following similar case:—

"If I stand in one part of my room, I see the sun through one pane of the window; if I move to another part, I see it through another pane; if two persons stand in the room, they see it through two different panes. Which pane does the sun shine through when no one is in the room, or does it shine at all?"

Of course, the answer is, that the sun shines through all the panes, but is only seen through that one which is in a line with the sun and the eye, and that his clock is reflected in every part of the mirror, but is only seen in that part which reflects the light from the clock to the place where he is standing.

Howard Grahame.

SKY AND WEATHER.

[1717]—May 8 (Pornic, Loire Inférieure), as the sun was setting, I noticed a rare white brilliancy around him, as after sunset in the days of the after-glow. Up to 11 at night there was a brilliant

light, which I hesitate to call auroral. It extended nearly to U. Maj. and Leo; was perfectly steady; about as bright as the zodiacal at its brightest; and had the sun's place for its centre. Small nimbi on it were black and well-defined; in the south-west dingy and ill-defined. The next evening after sunset there was a pink after-glow. As these phenomena came after a week of stormy, cold weather, they are probably terrestrial. I suppose my light was a faint aurora; its apparent relation to the sun may have been merely a coincidence.

Every one knows how cold the second week in May usually is; but I have not seen it noticed that there is as often a spell of real summer heat between the 19th and 25th of April. It would be interesting to know if our antipodes experience these two periods.

HALLYARDS.

SOLAR HALO.

[1718]—A very distinct halo was visible round the sun here at one o'clock on Wednesday, May 13. This appearance much resembled the more common lunar halo, but was more sharply defined and proportionally brighter. The radius subtended an angle of almost exactly 20°, and there was a yellowish iridescence in the inner edge of the ring. The sky was hazy, and the phenomenon lasted for some time. P. J. BEVERIDGE.

Ipswich, May 15, 1885.

A COINCIDENCE.

[1719]—Here is my latest "coincidence." As I once said, they are frequent with me.

Having been sitting writing for some hours, I got up—to fill a pipe, say—and then standing before the fire, and looking at the clock, it occurred to me that I had not wound it for some time. Now, winding my clock is a thing I never have done regularly—I always forget; but as it had been lately cleaned, and was in course of being regulated, I did not wish it to run down when last winding it, and so put a slip mentioning the date, &c., and adding—as it happened—the day, hour, and minute, when, according to an old estimate, it should run down. Herein lay the coincidence, for on taking out the slip and reading this, and then looking at the clock, lo! the hands of the latter indicated the hour and minute as written, and the date also was the same. It was not about the right time, to a minute or two more or less, but it was the very identical minute. And I hereby declare that I could not beforehand have said whether or not it was within two days even of the proper time. It was ten days since the slip had been written, and my memory is so bad that I only had a fancy that it was more than a week ago, and *might* be ten days. Apart from the date—the chances were 1,439 to 1 against the clock showing the right minute. I may add that though the putting up of the slip as a reminder was in itself not without precedent, the prediction on it was quite so, to the best of my recollection. J. HERSCHEL.

[Is Colonel Herschel thoroughly satisfied that this is—in any legitimate sense—a case of a mere coincidence? because I am not. It seems to me far more like one of "unconscious cerebration."—ED.]

CLUB TANDEM.

[1720]—In reply to "A Constant Reader of KNOWLEDGE," I should think that the new Club Tandem made by the Coventry Machinists Company would suit his requirements best. This has bicycle-steering for the gentleman and rack-steering for the lady. There are very few machines that would suit him. Levi has also a very good tandem for his particular purpose.

In either of these machines a portion can be ridden as a single machine, or the two combined as a tandem. Levi's is a hind-steerer, but perfectly safe. The Coventry Machinists Company's tandem has a small wheel both back and front.

I do not approve of any convertible sociable machines yet made. Tandems are faster, lighter, stronger, and much more portable; they only require a little more careful riding. JOHN BROWNING.

THE SCOPE OF *KNOWLEDGE*.

[1721]—The editorial groan in answer to me (May 8) suggests to me to appeal to fellow-correspondents on the subject of useless matter. The labour of merely reading—not to mention that the judicial faculty is to be kept constantly on the stretch—all that comes to a weekly journal is, of itself, so great, that if I had to choose between it and penal servitude, or the workhouse, I am not sure I would not prefer either to it. Why, then, tax still further already faculties sufficiently burdened, when what is written is quite out of place? If a man has a grievance connected with the Queen's Bench, would he write to the Archbishop of Canterbury for redress?

KNOWLEDGE is a scientific journal, and when we write to it we should leave our religious opinions at the door, as we do our sticks and umbrellas when we visit an exhibition. By confiding to the attendant things useless—possibly dangerous—when we are going, we in no wise show ourselves ashamed of them, or renounce resumption of them.

Every sane mind may be compared to the equilateral triangle inscribed in Euclid, i., 1, between the two intersecting circles, which are knowledge and faith—*i.e.*, all men are guided (*a*) by what they know; (*b*) by what they believe; which science has not taught them, and cannot despoil them of. *E.g.*, Mr. Bradlaugh has a pronounced religious belief, which is that there is no God. He cannot prove this, but it is his belief.

On the other hand, while stoutly upholding that no postulate, in science, must be made from unprovable belief, I cannot help thinking that (*a*) KNOWLEDGE has sometimes expressed opinions on religious topics which (by rule) should have been let alone; (*b*) that matter has been excluded as theological when it was purely scientific. A discussion on the *philosophical* and *physical* bearings of, say, Transubstantiation, seems to me perfectly within the scope of KNOWLEDGE. *E.g.*, I suggested lately, that if the molecules of ultra-gas have little or no attraction for each other, if single stars are in the same predicament, does it not look as if the universe was a gas, the stars the molecules? If so, *what* is the gas? The Pantheists hold that nature is the body of God, so to speak, that all is God. Well, I may be fanciful in thinking that the knowledge of the gaseous state is a step towards Pantheistic doctrine. But you, Sir, exorcised this as trenching on theology. How, I cannot see, since Pantheism is banned as dreadful heresy and blasphemy.

I am sure that, if Plato had been editor of an Athenian *Gnôsis*, he would have taken up this speculation, so like many he has left us, and I think the editor of KNOWLEDGE need not be ashamed of what Plato would have approved. KNOWLEDGE should treat *de omni scibili*. HALLYARDS.

[" There is," according to the old proverb, " many a true word spoken in jest," and really what " Hallyards " says in his exordium with reference to the mere physical labour involved in dealing with the huge and heterogeneous mass of correspondence which weekly reaches a journal like KNOWLEDGE, contains but little exaggeration. But I can scarcely go with him in his ideas as to the scope of such a serial as this, the avowed object of which is to expound the leading facts of science, natural and physical, in plain and apprehensible language. Now, I may be right or I may be wrong, but Transubstantiation appears to me to be a subject which is in no sense amenable to this treatment. It is a dogma of a particular sect of theologians, and to initiate a discussion into its nature—and even into its possibility—would be to open the door to a good deal that can in no sense, and by no conceivable perversion of language could, be called *Science* at all. I am not concerned to deny that, had Plato, as " Hallyards " says, edited an Athenian " Γνῶσις," he would have discussed such questions as those to which our correspondent adverts, keenly in its columns; but what appealed to the sophists and dialecticians of Athens more than 2,300 years ago may not, after all, be the most suitable intellectual food for Englishmen, who, towards the close of the nineteenth century, take in a popular magazine to learn something of the current science of the day.—ED.]

LETTERS RECEIVED AND SHORT ANSWERS.

HIBERNICUS wishes to point out that the words " conducting war on Christian principles " which appear on p. 379, in a review of " Essays on Economical Subjects," are the reviewer's own, and are not a quotation from his book.—LIEUT.-COL. CAMPBELL strongly recommends the " Rudimentary Treatise on the Integral Calculus " by Homersham Cox, published in " Weale's Series," as at once very cheap and excellent.—DR. LEWINS. Your letter of the 11th inst. merely reiterates, with slight variations, the arguments employed in the one which appears on p. 421.—G. HUMFRESS. No, all your experiment proves is that the lens showing colour was cut parallel to the axis of the quartz crystal. The one which exhibits no bands may also be a " pebble " lens properly cut—*i.e.*, accurately at right angles to the crystal's axis. Of course, it *may* be ordinary glass, but this is very unlikely. The test you applied will not solve this point. Get a broken bit of felspar (the greyish, and often reddish, constituent of granite), and try to make a minute scratch close to the edge of your lens. If the felspar fails to touch it, it is quartz.—SENEX. Just as you please. An ephemeron and a raven born on different days, then, but co-existing. Pray read the article " Nebular Hypothesis," in Nichol's " Cyclopædia of the Physical Sciences." The expression

"entering her first quarter," is simply applied to the arrival of the moon at that part of her orbit in which she is dichotomised, and is not intended to imply that she is beginning the first fourth part of that orbit. I note your desire that the attention of Mr. Mattieu Williams should be called to your communication on p. 324 of Vol. VI.—C. M. HARBORD. Gould's books "Birds of Asia," "Birds of Australia," "Birds of Europe," "Birds of Great Britain," "Century of Birds from the Himalaya Mountains," "Humming Birds," &c., will afford you a vast amount of information. They must be sought in some public library, like that of the British Museum. There is a gigantic American Ornithological work, too, whose title I have forgotten. The ornithology of Africa has, so far as I am aware, never been treated of as a whole. — H. TRUEMAN WOOD. Received with thanks. — AUGUSTUS J. HARVEY suggests the establishment of a National Phonetic Training College for Great Britain. — W. H. G. The puzzle of M. T. H. (letter 1701, p. 401) is not, as I understand it, as to the manner in which the rays of light are reflected from a mirror, but whether in the absence of a percipient eye there is any reflection at all?—H. R. B. Do you—or, in fact, does the Duke of Argyll—sufficiently distinguish between the inconceivable and the unbelievable? The King of Siam, who refused to credit the fact of the existence of ice, which was described to him by the Dutch travellers, did so on the ground that it was inconceivable. Had he, however, chosen (or rather been in a position) to investigate the matter scientifically, he might have satisfied himself of the possibility—nay, of the feasibility—of the solidification of water. That, however, $2 \times 2 = 5$, or that the three angles of a plane triangle can together be less than two right angles is absolutely unbelievable. Moreover, your illustration from mind and matter is a purely personal one. Dr. Lewins, Miss Naden, F. W. H., and others would tell you that no proof exists in the slightest degree of the action of mind (as a separate entity) on matter.—M. GORDON MUNRO. Your letter shall appear.—W. H. JONES. Inasmuch as the "Mind and Brain" discussion was drifting more and more rapidly in a merely theological direction, you will see that I have been compelled to stop it. —J. MACCALLAN. Scarcely a matter that I could "clear up" in a "line or two"—or a page or two either. See "Other Worlds than Ours," "The Borderland of Science," and "Science Byways," by the Conductor of this journal.—M. A. I have assuredly never heard of any one having offered a reward for the formation of magic squares of numbers of the form $4m+2$. Do any of our readers know of such an offer?—C. CALDICOTT sends (in connection with letter 1655, p. 289) a letter written by a lad between 12 and 13, whom he (Mr. Caldicott) has taught to write with his left hand. It is certainly an excellent specimen of caligraphy—bold, legible, and very superior to nine-tenths of the "right-handed" writing one meets with every day.—W. G. HOWARD. "You may as well kill a man," says an old proverb, "as frighten him to death." That the suggested Channel Tunnel may (or may not) be one of the greatest blessings that could be conferred upon England and France, and that the panics which would periodically arise might (or might not) be senseless, undignified, and short-sighted, are matters on which a diametrical difference of opinion may legitimately exist. Just so long as human nature is what it is, however, and the lamb, when he lies down with the lion, lies down (as the American observed) "*inside* him," I cannot conceive that any Government would be justified in subjecting the nation to the huge cost of periodical panics, be they ever so foolish or unfounded.—THEBERTON. Kindly read the reply to Mr. J. W. Frazer on p. 75.—W. CAVE THOMAS. I am in some difficulty with reference to your lecture on "The Bases of a Science of Æsthetics," inasmuch as it is far too long for reproduction in the present overcrowded state of our columns, and to summarise it as a contention that "a science of æsthetics must consist in rightly-formulated principles of proportion," is to do you but scant justice.—J. MURRAY. In the classical words of the clown in the Christmas pantomime, "Here we are again!" I have read through your communication, but (as the senior wrangler said upon the perusal of "Paradise Lost") "It doesn't seem to me to prove anything." With reference to your allegation that "As our earth diminish's the sun declines, just as I said twelve months ago," I can only observe that, unless your verbose statements of a preposterous hypothesis diminish, *I* must decline (to further notice them), as I said six months ago.—MISS M. B. ALDER. Many thanks. Forgive me if your arguments fail to convince me.—CAPTAIN NICOLLS, R.N. Thanks; but we have such a redundancy of matter in hand, that I could only accept it as a voluntary contribution.—DR. BARNARDO. Thanks, but it is quite outside of the province of a journal devoted to science.—JOHN STANTON. The specific gravity of ice is 0·9184 (that of water being, of course, 1·000.) In the act of freezing water expands very considerably, so that 174 volumes of water at 60 Fahr. become 184 volumes of ice. Water, like the vast proportion of bodies, goes on contracting until it reaches a temperature of 39 Fahr., at which it is at its maximum density. Then it begins to expand, and continues to do so, as I have just said, until, becoming ice, its expansion is very considerable. Bismuth acts in a somewhat similar fashion.—T. C. TOWNSHEND. I know nothing of Mr. Morrell's address, but have forwarded your card to the office in case any one there may be acquainted with it. If tradesmen will not advertise their addresses I must certainly decline to act as intermediary between them and their intending customers.—RICHD. JARMAN asks for the meaning of "Fan Structure" as a geological term. It was asked, he says, at the last South Kensington Science Examination. Myself a practical geologist, and familiar with every standard work on the subject, the phrase is new to me. Doubtless it is to be found in one of the wretched cram books compiled by some official of the "Department."—HOWARD GRAHAME. The dynamics of a spinning-top would rather require a series of articles for its explanation than admit of being made plain in an answer in this column. Have you never heard that Euler wrote an entire volume *De motu turbinis?* You may go on teaching the wave theory of light in absolute disregard of Sir W. Thomson's reported utterances. The (comparatively) trivial difficulties to which he adverted will all be removed in due time. Do you not remember that, prior to the discovery of Neptune, it was gravely alleged that the law of gravitation broke down at Uranus? Yes, in any given medium the red does travel faster than the violet. The word "cloud" should be, as you say, "closed." "Pane" is quite right. I am not quite sure what "Hallyards" meant in the words you quote. Speaking generally, of course the greatest heat is to be found at the least refrangible end of the spectrum. I really cannot explain to a third person a reply to a communication addressed to me by a second, in connection with which it is quite intelligible.—W. K. BRADGATE. Undoubtedly, as the sentence stands, Humboldt (who was no more infallible than any one else) made a mistake. I suspect, though, that he must have meant that the comet was only visible in a telescope at the time of its discovery by Pons, and that he inadvertently omitted to qualify his statement as to its invisibility.—LAWRENCE HARGRAVE. Model of your trochoided plane flying-machine received. As far as I have experimented with it, it exhibits an unfortunate tendency to pitch straight down to the ground, on one end.—EXCELSIOR. Your difficulty having been cleared up, I really cannot continue to forward such bolsters of MS. as those which reached me to-day. The proper motion of the earth is invariably taken into account in estimating the rate of appreach or recession of a fixed star from the change in its spectrum. Before framing hypotheses and dogmatising on such a question as this, it might be expedient to make yourself acquainted with the literature of the subject.—G. L. BROWN points out that, in his letter (1704) on p. 420, "*o* Cancri" should have been σ^2 Cancri.—E. W. P. I see, and to a certain extent sympathise with the drift of your remarks. The cases, however, are not strictly parallel. All telescopes are identical in construction; and to mention the name of individual makers of them is really and truly to advertise particular tradesmen. In the case of tricycles, the various forms described by our contributor differ *inter se*. Hence, in saying that Smith's Lightning Express is a better form of machine than Jones's Hurricane Rear-steerer, he is, in reality, only giving utterance to something equivalent to the assertion that for showing planetary detail, &c., a reflecting telescope surpasses a refractor of the same price. All the same, I should be glad for the trade-element to be kept as much as possible out of the articles on which you comment. I differ with you entirely on the subject of the "Young Electrician" articles, which are intended to instruct the student in making his own electrical apparatus. Surely this is applied science "plainly worded—exactly described." As to the Workshop essays, they are written as supplying a pleasant means of recreation. We in no sense whatever enter into competition with the journal to which you refer. I am obliged to you for your intimation of the opinions of yourself and your friend; but must, at the same time, assure you that they differ, *toto cælo*, from those of other correspondents. I have given up, as an utterly hopeless task, the attempt to please everybody, and have taken to heart the moral of the fable of the Old Man and his Ass.—DIVERS CORRESPONDENTS, from whom some quires of MSS. have accumulated, are once more requested to note that I neither can nor will return rejected contributions unless they are accompanied by envelopes legibly addressed and sufficiently stamped. Furthermore, I must ask them kindly to note that I must claim absolute power to reject *any* communication, without assigning reasons for so doing; and that I utterly refuse to enter into correspondence with the authors of papers which I regard as unsuitable for the columns of KNOWLEDGE, to argue as to their contents, or to justify any action which I may see fit to take with reference to them.—E. L. G. Many thanks; delighted to see your handwriting again.

Our Inventors' Column.

We give here, week by week, a terse description of such of the many inventions as we think may be of use to our readers. Where it is possible, the number of the patent is quoted, to enable those who desire fuller information to procure the specification from the Patent Office in Cursitor-street, Chancery-lane. We shall, generally speaking, confine ourselves to the more recent inventions; but it often happens that an article comes under our notice which, although not quite novel, is worthy of mention for its utility and ingenuity. In such a case we should not hesitate to refer our readers to it. And while we thus increase the interest of our pages, we at the same time assist the inventors by giving greater publicity to their inventions (KNOWLEDGE *being a popular magazine*) *than is accorded by the most excellent trade journals.*

GYROSCOPE.

[Patent No. 6,842. 1884.]—Mr. V. Falkner, of Southport, has devised an improved gyroscopic apparatus for use in navigation, geodesy, and astronomy. The invention is based on the well-known property of rapidly-rotating masses, or gyroscopes, of resisting tendencies to motion about other axes than those of their rotation, and the ability of such masses, or gyroscopes, to remain stationary with regard to the earth's rotary or curvilinear motions, or motions of themselves, upon the earth's curved surface, as instanced by Foucault's gyroscope. This property results from the reversal of direction of tendency or momentum as the disc rotates. A force tending to rotate the disc in one direction at one instant acts against itself in the next when the disc has moved round, thus setting up a stationary state against small forces in its equilibrium when going round at high speed.

Masses, discs, and gyros, suitably shaped, and mounted on spindles in bearings, the form being preferably cup-like, to bring rims as near about a centre as possible, and the directions of motion reversed to one another, or so ordered as to balance rotational effects of their friction in bearings, are caused to rapidly rotate by friction and toothed gearing, acted upon by pistons, cylinders, &c.; the whole being enclosed in a shell or ball exhausted of air. The ball has two pivots or poles, mounted suitably in a horizontal gymbal ring, within which it is free to turn about its axis. The horizontal ring is again pivoted to a vertical ring and axis, the combination admitting of rotary motion of the sphere or ball about any axis.

The whole is enclosed by an outer shell, cover, or receiver, and power is communicated to the cylinders, &c., by compressing and exhausting the air in the cover surrounding ball, or by alternately varying fluid pressure between them. The exhaustion in the interior of ball may be thus at intervals renewed and maintained, and the ball is free from tendencies to move, or prevent motion by the communication of renewed speed to the gyros within it, the resistances to be overcome being rendered sensibly those of the pivots alone. The admission of fluid to and from the cylinders is effected by openings into them disposed evenly about the axis or pivots of sphere.

When the gyros rotate at sufficient velocity, the earth's rotary motion will be repeated on the sphere, a greater or lesser degree of such motion taking place as the instrument is moved east or west on the earth's surface, and the axial inclination (parallel to earth's axis) changing to a vertical to earth's surface at the poles, and to a horizontal at the Equator, and so on; but always maintaining a true compass direction (horizontally read).

The instrument will thus show points of compass, local time, (and by comparison with chronometer) longitude and the latitude, when fixed or moved upon the earth's surface, with slight variations for curvilinear motions of earth and solar system, which latter may be read from a stationary instrument and utilised astronomically.

COMPASS.

[Patent No. 6,288. 1884.]—Mr. F. M. Moore, of 102, High-street, Belfast, has patented a form of mariner's compass, in which he strives to overcome what is called the error of "heel." Usually, correcting magnets are placed on the deck and on the binnacle, but Mr. Moore points out that, as the ship rolls, the position of these correctors is constantly changing in relation to the magnet. He therefore suspends his needle in a lower well in the compass-box, and attaches to the outside of the box, and in the same plane as the needle, quadrantal correctors, consisting of soft iron balls. He also places in the box, so that they may move with it, a number of correcting magnets. The relation between the needle and the correctors remains therefore invariable, whatever ordinary position the vessel may assume.

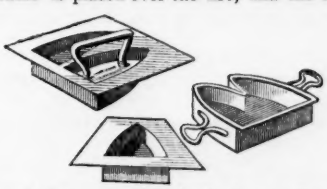
CONTRACTIBLE PERAMBULATOR.

[Patent 8,294, 1884.]—This invention, taken out by Mr. A. Harvie, of St. John's-street, Islington, is more especially applicable to households where compactness is a desideratum. When opened, it is an ordinary perambulator for two children seated *vis-à-vis*. A key turned from the rear acts upon a screw, and contracts the vehicle by drawing the front section and wheels under the back

portion, the handle, at the same time, being raised into an upright position. The principle appears to be new, and the carriage to which it is applied has the advantages of being light, simple, and elegant. When reduced to the smallest dimensions, the space occupied does not exceed 21 inches either way. In virtue of this, it may easily be made to traverse crooked or narrow passages and staircases.

FLAT-IRON HEATER.

[Patented 1884.] — Mr. Bayley, of High-street, Poole, has patented a useful article for home use. It is called a flat-iron heater, and consists of a framework, or pocket, of iron, shaped to contain one or more irons, adaptable for either an open or closed grate. The frame is placed over the fire, and the iron is rapidly



heated, being at the same time kept clean and ready for use. Different forms are illustrated. Those with the plate are made to cover up the openings in the close kitchener, while for open ranges and other kindred stoves the iron plate is dispensed with, and handles are substituted, which serve to support the well, or pocket, by resting on the hobs of the grate and spanning across the fire.

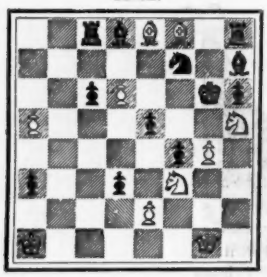
SIXPENNY TELEGRAMS.—Extensive preparations are being made by the Government for the new system of sixpenny telegrams. The extensions have been made on the basis of an estimate that the reduction in tariff will cause an increase of the business of the department to the extent of 30 per cent. within the first year, and the extra expenditure already incurred amounts to half a million sterling. Of this amount £475,000 has been spent on new plant—poles, wires, instruments, &c., whilst £25,000 has been laid out in the erection of new buildings. The length of public road upon which new poles have been erected in England is 850 miles, apart from the extension on railway routes, and upon these poles there have been placed 9,200 miles of new wires, in addition to which there are about 11,600 miles of new wires put up on existing road or railway-poles. In London, the number of offices at which the pressure of business is met by the use of pneumatic tubes will be increased by the use of an additional length of 7,500 yards of tube. The increased staff throughout the Kingdom will include 1,200 new telegraphists and over 1,000 messengers.

Our Chess Column.

By Mephisto.

SOLUTION OF PROBLEM No. 156.

Black.



White.

1. Q to Kt6! B × Q
2. Kt × KP (ch) K to Kt4
3. B to K7 mate

(*a*)

1. R to QKt sq.
2. B × BP Kt × P (best)
3. B to K8 mate

(*b*)

1. B to B3
2. Q to Q4! P × Q
3. Kt × P mate

(*c*)

1. B to Kt sq.
2. Q to Kt4 &c.

Other variations obvious.

Sir,—It is only fair to say that I take in the "Chess Monthly," but I do not as a rule solve the Problems in it, and had not seen "Traumerei's." I have honestly solved it, after many unsuccessful attempts, and got someone else to refer to the solution in the April number and to tell me, *not* what the first move was, but whether mine was right. I was rather "struck of a heap" to be told it was *nothing like it*. It turned out, however, that my friend (not a Chess player) was referring to the statement of the *position*, which precedes the solution. Then I fortunately remembered the practice of giving the position, explained matters, and the result did me good.

As to the Problem, it is certainly a very fine one, and deserves the remark of one of the "Chess Monthly" solvers—"a masterpiece, combining beauty, brilliancy, and difficulty in a very high degree." I felt sure some days ago that Q to QKt6 must, or ought to be the first move, but I stuck at the variaton 1. R to QKt sq. I have put that as the main line of play, because I think it even prettier than 1. B to KB6, 2. Q to Q4, &c., which is certainly good enough in itself as the central idea of a problem. W.

White, S. Winawer, conducted this End Game with remarkable ability, as will be seen from the notes, which are by Steinitz.

White.	Black.	White.	Black.
34. R to KB2 (*a*)	P to B3 (*b*)	46. R to Kt5	K to R2
35. P to B4	P to B4	47. P to Kt4! (*e*)	RP × P
36. Kt to K3	R to K sq.	48. P to R5	R to QKt sq.
37. R to QR sq.!	R to KB sq.	49. R to QKt3	R to QB2
38. R to R3 (*c*)	R to QB sq.	50. R to Kt sq.	R to Q2
39. R to Kt3	R to B sq.	51. R to R sq. (*f*)	R(Kt sq) to Kt2
40. Kt to B2	R to QR sq.	52. P × P (ch)	K to Kt sq.
41. K to Kt sq.	R to K sq.	53. R to R6	R to Q sq.
42. K to B sq. (*d*)	R to QR sq.	54. R × BP	Kt × RP
43. R (B2) to B3	R to K sq.	55. R (B5) to R5	K to B sq.
44. Kt to K3	R to KB sq.	56. P to B5	P to Kt6
45. Kt to B5	R to K sq.	57. P to B6!	P to Kt7

White mates in two moves.

NOTES.

(*a*) By this fine move the adversary is prevented from bringing the Kt over to his Q side *via* K3.

(*b*) If Kt to K3, White would have won easily by 35. P × Kt, R × R. (The reason why the other R has been removed will now be perceived. It was to prevent its being captured with ch). 36. Kt to Kt7 and wins.

(*c*) While Black can do nothing, White is preparing a series of manœuvres which in their content form one of the most beautiful ending competitions in actual play.

(*d*) All necessary for his plan; he will not allow the adverse Kt entrance to his game at K2.

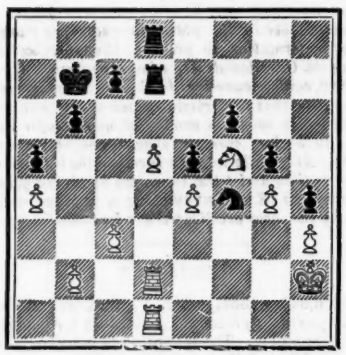
(*e*) At last the extraordinary deep plot comes to a head. Everything is protected on White's side, and by splendid strategy he has prepared victory on the Queen's wing.

(*f*) The execution of the plan is quite in keeping with the whole masterly design.

ENDING FROM ACTUAL PLAY.

B. English.

Black.



White.

S. Winawer.

It affords us great pleasure in being able to announce that three important tournaments have been arranged to take place within the next three months. Two of these are likely to be of high interest to Chess players, as it is expected that some of the best players will be amongst the competitors. First comes the Hamburg Tournament, of the German Chess Association, open to all comers, with prizes from £60 downwards. This contest will begin on July 12.

Of most interest to English players will be the meeting of the Counties Chess Association, which will be held at Hereford, beginning on August 3. This meeting will be a memorable one, as the prizes provided exceed anything hitherto attempted by the C. A. The Society has made a bold—and we must confess successful—bid for popularity by departing from their former custom to provide tournaments for amateurs only, and arranging a "Master Tournament," open to all comers, with most liberal prizes of £60, £25, £15, and £5. There are about six separate tournaments, open to amateurs only, of various strength, for which at least between £70 and £80 will be available. £10 is set apart for a Problem Tournament. A week's Chess at Hereford will indeed be a week well spent for amateurs desirous of taking a holiday.

The British Chess Association has likewise come to the fore, although barely established yet. Contrary to expectations, however, first-class players will be excluded. Liberal prizes to the amount of £40 are provided for the Tournament, which is to take place at Simpson's, and begin on June 12 next. A Problem Tournament is likewised announced. Programmes of the Counties meeting may be had from the Rev. A. B. Skipworth, Telford Rectory, Horncastle. The Hon. Sec. of the British Chess Association is L. Hoffer, 21, Fulham-place, London, W.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

A. F. Baker.—The intended solution of this problem, P × P in passing, did appear in Knowledge, but the problem is rubbish, and all similar ideas have long been worked out by Klott, Pearson, and others.

Correct solutions received from W. Ravenshoe, M. T. Hooton, E. Louden, W. Furnival.

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